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Marshall, Regent's Park road—
Secretary 55
No. 521, L.O., Strand—
Chauffeur 55
No. 522, L.O., Strand—
Companion Help 55

The Harveian Oration:

HARVEY'S WORK CONSIDERED IN RELATION TO SCIENTIFIC KNOWLEDGE AND UNIVERSITY EDUCATION IN HIS TIME.

Delivered before the Royal College of Physicians of London on Oct. 18th, 1917,

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MR. PRESIDENT, FELLOWS OF THE COLLEGE, AND GENTLEMEN,—In the first place I have to thank you, Sir, for entrusting me with the most honourable duty of delivering the annual oration founded by our greatest associate, Dr. William Harvey, the supreme glory of our College, whose memory we all cherish and whose work is universally regarded as the peculiar pride of English medicine. In founding this oration he enjoined in the deed of gift that the orator should exhort the Fellows of the College to search out and study the secrets of nature by way of experiment, and for the honour of the profession to continue in mutual love and affection among themselves. It was also his wish that on this occasion should be commemorated those benefactors of the College who by gifts or by their contributions to medical knowledge have forwarded the interests of this College in the course of the bygone year.

RECOGNITION OF HARVEY'S WORK.

Harvey's work has been justly regarded as remarkable by its great success in his own lifetime, and especially in his own country and among his colleagues in this College, where there appear to have been no discordant voices. So far from it being true, as a recent British writer has ventured to say, that the only criticisms on his work were heard from his fellow-countrymen, the very contrary is the truth, and, as Willis expressly says, the appearance of Harvey's book seems almost immediately to have attracted the attention of all the better intellects among the medical men of Europe. The controversy on the circulation was carried on abroad rather than at home, for Harvey seems to have won over to his side all the men of his own country who by their education and acquirements might have been fitted to array themselves against him, and the first publication to deal with the question by one of Harvey's countrymen was that of Dr. George Ent, who undertook to defend Harvey's teaching against the criticisms of Parisanus.

A century had to elapse before the voice of criticism was heard from any British authority, and then it was the extremely able but somewhat quarrelsome anatomist Dr. William Hunter, who sought to depreciate the work of Harvey by comparing it with the discovery of America by Columbus, and the astronomical induction of Copernicus, disparaging Harvey's mental abilities on the ground of his failure to recognise the value of the discovery of the lacteals by Asellius, whose book was published about the same time as that of Harvey on the Circulation of the Blood (1627). William Hunter's quarrel with his glorious brother John over the placental circulation does not show him in a very amiable or even an altogether honest light; and much as we may regret that so able an anatomist should have adopted this hypercritical attitude, I think we may fairly say that his comments in no way succeeded in diminishing the glory of Harvey.

CONTRIBUTIONS TO HARVEIAN LITERATURE.

Successive Harveian orators have so diligently explored the somewhat scanty literary remains that throw any light upon the life and doings of our illustrious fellow countryman, that the College warmly appreciated the address by the late President, Sir Thomas Barlow, who occupied this chair in October, 1916, and by his munificence had placed in the possession of the College certain documents, consisting of eight of Harvey's own letters written at the time when he accompanied the Earl of Arundel on an embassy to the Emperor Ferdinand. Although these letters deal with only a short episode in the life of Harvey and throw no light whatever upon his physiological researches, they are exceedingly welcome as being contemporary accounts in his own handwriting, illustrating some at least of the difficulties that a traveller in those days met with even when forming part of the suite of a British Ambassador. It is not often that a Fellow of this College enjoys the opportunity of making a benefaction which is so closely related to the personality of Harvey, but it is possible that in the much greater attention now paid to the State papers which were so long neglected, more may be found bearing upon the life of Harvey in his position at the Court of Charles I., where he undoubtedly enjoyed the favour and the personal friendship of the King.

The College must acknowledge a valuable contribution to its Harveian literature in the publication of a memoir to recall the seventeenth century friendship of Finch and Baines, written by Dr. Malloch, a Captain in the Canadian Army Medical Corps. These two graduates of Cambridge in the seventeenth century went from Cambridge to France and thence to Padua, where the professor who lectured to them on anatomy was Antonio Molinetto. Finch was a brother of Lord Nottingham, whose niece was the wife of Harvey, for whom he entertained the greatest veneration. From Padua they went to Pisa where Finch was appointed professor of anatomy, his course of lectures including both morbid and comparative anatomy. While there he examined a live torpedo (*T. narce*) sent him by the Grand Duke of Tuscany. He describes a "pricking sensation like that which comes when you suddenly put cold fingers to the fire," on touching the fish. Later when it died he dissected it and his report is extant; it is to be issued shortly by the Historical MSS. Commission edited by Mrs. Lomas. The friends returned to England soon after the Restoration, Baines being appointed professor of music at Gresham College, and both were unanimously elected Fellows of this College, partly no doubt on the ground of their relationship by marriage and friendship with the illustrious Harvey. Soon after they received their degrees as Doctors of Physic at Cambridge, and in the same month the King knighted Finch, the like honour being conferred on Baines 11 years later. Finch returned to Italy and again taught anatomy at Pisa. In 1665 he was appointed the King's resident at the Court of Tuscany and stayed there with Baines until the death of the Grand Duke in 1670. Finch was next sent to the Porte as English Ambassador and remained in Turkey till 1681 when Sir Thomas Baines died, and Finch brought the body home; he died shortly after, according to his epitaph—"Of sorrow at the loss of Sir Thomas Baines." They were both buried in the chapel at Christ's College, Cambridge, where in memory of their friendship Finch founded two fellowships and two scholarships.

BENEFACTORS OF THE COLLEGE.

Among the great benefactors of this College whose names cannot be passed over in silence are the two Hamey's, father and son; Theodore Goulston, founder of the Goulston lectures; Sir Theodore Mayerne; Dr. Richard Caldwell, who with John Lord Lumley founded the Lumleian lectureship; Lady Sadlier, founder of the Croonian lectureship in memory of her first husband, Dr. William Croone; Dr. William Wood Bradshaw, founder of the Bradshaw lecture; Mrs. FitzPatrick, who founded the FitzPatrick lecture on the History of Medicine in memory of her husband, Dr. Thomas FitzPatrick; and Dr. Gavin Milroy, one of the pioneers in the subject of public health, who left £2000 to endow a lectureship on State Medicine and Public Health and Subjects Connected Therewith. Further, as announced by Sir Thomas Barlow last year, there is the foundation of the Streatfeild Research Fund, endowed with £10,000 in 2½ per cent. annuities given by Mrs. Eliza Streatfeild for the purpose of the endowment of research, the fund being vested in the joint names of the two Royal Colleges, who act as its administrators.

On Dec. 16th, 1916, the College received through our Fellow, Dr. Malins, of Birmingham, a gift of £500 from Mr. F. W. Mitchell, to be devoted to the object of the research, investigation, and treatment of tuberculosis.

On Oct. 26th, 1916, under the will of Mrs. Fanny Hertz, of 40, Lansdowne-crescent, W., the College became possessed of a fine portrait of the late Dr. J. E. Bridges, which has been hung in the hall

In addition valuable donations of books have been made to the library.

A CRITICISM OF HARVEY'S VIEW.

An instructive criticism of Harvey's opinions was published two years ago by the late Professor Curtis, of Columbia University.[1] In Harvey's life-time he was often asked by his opponents to explain the purpose of the circulation, and he was never able to give a satisfactory reply. Why should the blood traverse the lungs, return to the heart, be distributed to the whole of the body, and then be brought back again to the heart in order to be transmitted again through the lungs? What did the blood gain by its passage through the lungs? Harvey taught that it was ventilated or cooled there, deriving heat from the heart which was the centre of bodily heat. We may wonder why Harvey, following Aristotle, should regard air as cooling fire. Surely the effect of air on fire must have been known to him, and it certainly seems strange that Aristotle should have said that air keeps fire from consuming the fuel too fast; was he not familiar with a smith's furnace, and with the manufacture of charcoal by limiting the access of air? Harvey knew that air was necessary to a candle and to fire, but did not know why. He accepted the doctrine of "spirits," an expression used by Aristotle, Erisistratus, and Galen, as something derived from the air and introduced into the circulation with the blood (Erisistratus) or by itself (Aristotle).

Nearly a hundred years before Harvey's time Realdus Columbus (1559), taught that air was mixed with the blood in the lungs, where the transfer took place from the right to the left side of the heart. But this great fact that the blood in its passage through the lungs took up air was rejected by Harvey. He heads the passage: "Spirits not from Air," and he quotes an experiment to show that air does not pass into the blood, as he evidently expected to see the blood frothy if this were so.

Harvey maintained these views all his life and never understood the function of respiration, which is not surprising, as he was ignorant of the nature of combustion, of oxidation, of the corpuscular structure of the blood, and of the function of hæmoglobin. He was unable to explain the difference in colour of arterial and venous blood, but he sought to minimise the importance of this by pointing out that both when drawn and allowed to stand become nearly the same colour and not of any great difference of either consistency or bulk. He knew that during life the arterial blood in the lungs was redder and that the lungs were florid. He could never explain why the fœtus could live without air and yet after birth be readily suffocated by air being excluded. He always followed Aristotle in the doctrine that the heart was the primordial centre of life, and Curtis thought that Aristotle was familiar with the pulse from observing the incubating egg, where the heart makes its appearance early, and to which he consequently attributed all the chief functions of the body, including the affections, feelings, senses, and the like. Hence we still speak of the heart as the seat of emotion, of "a change of heart," "Unto Thee all hearts are opened," "Cleanse our hearts," &c. It never occurred to Harvey to inquire into the nature of the fumes given off during expiration. In Harvey's time the view was generally held that the blood is distributed to the tissues from the liver in spite of the existence of the pulmonary artery and the lungs in life being full of blood, but it is probable that medical men were blinded by the fact that after death the lungs are usually bloodless.

Harvey, moreover, was not constant in his allegiance to the heart as the centre and source of the motive power of the circulation, for as early as his lecture notes of 1616, and even in his latest utterances, he regards the blood as endowed with movement, and in his treatise on Generation he asserted the primacy of the blood—"the leaping point"—the pulsating vesicle which he regarded as the first beginnings of the embryo. The blood, he says, is prior to its receptacle, the contained to its container. He maintained that the order is first the blood, second the pulsation, and third the vesicle. The blood is the "first to live and the last to die." Here, as Curtis says, Harvey was misled by his confidence in what we call naked-eye appearances and his want of better appliances. It would have been logical of Harvey had he attributed the pulse and the heart beat to the "leaping blood," but in his letter to Riolanus he says it was due to the boiling or bubbling of fermentation. He thought the swelling of the blood caused by its innate heat stimulated the auricle to contract, and he located this effect just between the openings of the superior and inferior cavæ, where we now place the bundle of His. The contraction of the auricles is, then, the cause of the contraction of the ventricles.

Curtis points out the difficulty Harvey was in owing to the backward state of physics. He was 14 years younger than Galileo, who was unable to explain the common pump, and Harvey's discovery was made public 13 years before Torricelli's momentous work on the movement of liquids. We must therefore recognise that many of the questions which by us are readily answered were in the days of Harvey quite insoluble, but we owe him our gratitude for the enormous advances he made with the means at his disposal.

CAMBRIDGE UNIVERSITY IN THE SIXTEENTH AND SEVENTEENTH CENTURIES.

It is of interest to inquire what were the opportunities afforded by Cambridge to the student who desired to study medicine, and how far it was possible for him to set out on the path of such learning as in those days would be regarded as at least preliminary to his studies.

The sixteenth century was not favourable to the English Universities. They suffered greatly from the religious convulsions of the period. Not only were the abolition and disendowment of the religious houses causes of financial embarrassment, but sectarian considerations rather than those of character and learning were paramount in the choice of the heads of houses and professors. Religious differences could not but influence the willingness of parents to send their sons to the universities and the resulting decline in numbers with the consequent loss of pupils' fees, impoverished the University exchequer, and such was the lowering of the standard of scholarship that the libraries were spoiled by the selling of so-called "useless" books.

The University in the Reign of Edward VI.

On the other hand, in the reign of Edward VI. (1547–1553) were founded the five Regius professorships in Divinity, Civil Law, Physic, Hebrew, and Greek, each being endowed with a stipend of £40, and so far as it goes we may take the professorship of physic as some evidence that the study of medicine was not altogether ignored. The first incumbent of the chair was Dr. John Blythe, of King's College, an M.D. of Ferrara, for at this time and perhaps for a century later Cambridge men had to go abroad for instruction in strictly professional subjects. John Caius left Cambridge in 1539 for Padua, where he lectured on Aristotle, in return studying "Medicine and Anatomy," which is some evidence that at Cambridge these subjects were less cultivated than Greek.

In the reign of Edward VI. the university attracted many students, of whom too many were absorbed in theological controversy (Ascham), moreover it was complained that the majority were mere boys, the sons of wealthy parents, who never became serious students but by their presence interfered with the attendance of a poorer class who would give up their whole time to study. The prevailing spirit of the university was indolence. In 1558 Caius had spoken of the disappearance of "the poor modest diligent student who rose early, lived on scanty fare and respectfully capped his seniors." Gone, too, were the dignified elders of former times, of sedate countenance and stately mien, punctilious in wearing academic dress and punctual in attendance at the disputations in the schools. The undergraduates had discarded long gowns and caps, their garments were gaudy, they gambled and drank, and discipline was so much relaxed that those whose misconduct led to their expulsion from one college had no difficulty in obtaining admission to another.

The offices of the University became sinecures; for example, there seemed to be no objection to Ascham, the public orator of the University, living abroad, while Ridley retained his Mastership of Pembroke when Bishop, at first of Rochester, and afterwards of London. The Doctor's degree was taken in scarcely any faculty, and as there were no examinations, and disputations had become neglected, such as were given could scarcely be regarded as evidence of learning or ability. If Cambridge had not sunk as low as certain German universities which Bucer condemns for

[1] John G. Curtis, M.D., LL.D.: Harvey's Views on the Use of the Circulation of the Blood. New York: Columbia University Press. 1915.

giving degrees for money, yet there was much indolence among the resident Fellows, who lived like drone bees on the fat of the colleges.

In the new code of Edward VI., introduced in 1549, the text-books of the professor of medicine were to be Hippocrates and Galen.

Foundation of Caius College.

In the reign of Mary (1553–1558) there was little in the state of the University to give satisfaction to any lover of learning, and the only fact which at this time can be regarded as conferring a real and permanent benefit upon the University was the foundation of the College that bears the name of Dr. Caius, who was private physician to the Queen, was nine times elected President of this College, and bore a professional reputation inferior to none of his contemporaries in this country.

Dr. Caius was a staunch Catholic, but he had travelled and seen much of men and things so that he possessed an open and tolerant mind. He had studied anatomy under Vesalius at Padua, had visited other Italian universities, and had formed the acquaintance of the chief scholars of France and Germany. Being unmarried and wealthy and somewhat of a recluse, he retired to Cambridge, where he became a Fellow of Gonville Hall. In 1557 he obtained a license from Philip and Mary to refound the College as co-founder with Edmund Gonville and Bishop Bateman, endowing it with the manor of Croxley and Snellshall and several other properties. When the College was reconstructed in 1572 it was to consist of a Master, 13 Fellows, and 21 scholars, the Master being a Bachelor or Doctor of one of the three faculties.

It is noteworthy as bearing upon the question of the state of medical education in Cambridge that the holders of medical Fellowships and *those only* were permitted to repair for the prosecution of their studies to the continent, for, says the statute: "Theology and Civil Law may be studied just as well here as there," and it is fair to infer that medical science could not. These travelling Fellows were required to go to a "good school," preference being given to "Padua, Bologna, Monte Pulciano, and Paris."

Neglect of Learning.

On the accession of Elizabeth the fresh instructions to the Commission for the Reorganisation and Reformation of the Universities followed closely those (1549) in the reign of Edward VI., but with the notable omission of the clause for the foundation of a Chair of Medicine and one of Civil Law. It is not necessary to recount the troubles and differences which occurred at Caius College owing to the personal unpopularity of Caius, who was disliked by the majority of the Fellows and who retaliated by showing his contempt for their indifference to learning and their lax conduct, the manners of the students of this period leaving much to be desired.

We have seen that a generation before the study of Greek was pursued with much success at Cambridge, but it had become so neglected that eminent scions of the University, like Whitgift and Walter Haddon, were ignorant of it, and Giordano Bruno, who visited England and Oxford in 1582, complains that the Oxford undergraduate "drank too much beer," while his seniors were "pedantic and stupid;" but perhaps it is unfair to assume that these faults extended to the sister University. Companionable behaviour, the capacity to sit long at table after dinner and supper, were more helpful to a degree than reputation acquired in the schools or any display of ability there evoked.

The attendance upon the lectures of the University professors fell off, no doubt in part in consequence of the development of the college system, undergraduates preferring to get such instruction as they desired in the class-rooms of their college tutors; but if to the college system may be not unfairly attributed the decay of professorial teaching at Oxford and Cambridge, it may, on the other hand, be credited with having preserved these institutions from such stains on morals and manners as still mar the reputation of the chief German universities.

When Caius was in Italy he was a zealous disciple of Giovanni di Monte (1508–1552), who was the first modern to teach medicine at the bedside, which he did at the hospital of St. Francis. Unfortunately, Caius did nothing to transplant this method to his native country, and it was at least two centuries before clinical teaching was practised, even in a rudimentary fashion, in British hospitals.

Francis Glisson, Regius Professor of Physic at Cambridge.

The career of Francis Glisson, a former President of this College, illustrates to some extent the state of medical education at Cambridge, where he was Regius professor of physic from 1636 until his death in 1677. He entered Caius College in 1617, graduated B.A. in 1621 and M.A. in 1624, M.D. in 1634. He lectured at first on normal, morbid, and comparative anatomy, and in 1640 he gave the Goulstonian lectures of this College. Up to this date—that is, four years after being appointed Regius professor—he lived in Cambridge, but in 1640 he took a house in Colchester, where he "soon obtained much practice" and where he continued to live until after the siege of that city, when he became much impoverished and moved to London. Here he took a house in New-street, in the parish of St. Bride's, and resided there up to his death in 1677. He was President of this College in 1667–8–9. In 1675 the University obliged him to appoint Dr. Brady as his deputy at Cambridge, but the fact that he was non-resident for over 40 years of his incumbency of the professorship may not unfairly be taken to indicate the little interest felt in medical education at Cambridge.

As is well known Glisson was an energetic student of his profession and published many valuable monographs, especially that on Rickets and on the Anatomy of the Liver; by the latter his name has been preserved and is familiar to all medical students from "Glisson's capsule," applied to its external fibrous sheath. His portrait painted at the age of seventy-five is in the possession of this College.

WEBSTER'S "EXAMINATION OF ACADEMIES."

One looks to Webster's book, the "Examination of Academies,"[2] for a criticism of the work of the University at or about Harvey's time, but it is disappointing. Webster was evidently a fanatical puritan who found fault with the Universities because they professed to train men for the ministry, whereby they are said to fill them with vain knowledge. He expressed doubt whether the knowledge of Greek and Hebrew could in any way aid the right understanding of the Gospel, and thought that only the Spirit of Christ could convey this information. He praised such mystics as Jacob Boehme; he believed in the existence of a Heavenly dialect which was what John heard and God used in speaking to Adam; that animals probably communicated with one another by it.

He objected to the Aristotelian philosophy and preferred to it the teaching of the Rosicrucians, and that of our "learned countryman" Dr. Fludde. He condemned the medical profession for adhering to what he calls "ignorant, wicked and blind Pagans," for neglecting magic and cabalistic science and that "great book" the "Macrocosm" of Paracelsus. He quoted with approval the saying, "For the Lord hath created the physician not the schools," and he condemned the neglect of that "laudable, excellent, and profitable science" of physiognomy, the neglect of the science of Celestial signatures, and the study of natural dreams.

Coming to more reasonable criticism he found fault with the uniformity of method followed in teaching by the slothful performance of the Acts, there being only four in the year, to these being conducted in Latin, which tended to obscurity and to the neglect of our mother tongue. He says that the "Romans used Latin and prohibited Greek" (?), while the Greeks wrote in their native language. He thinks too much importance is assigned to the opinions of the ancients, and that Lord Bacon has indicated a better method than that of the scholastic philosophy, that physics and chemistry should be taught by laboratories as well as libraries.

While there is much in this with which a modern would agree, the criticism on the whole is peevish and unreasonable, and suggests nothing that has any direct bearing upon the improvement of medical education.

Webster seems to have had small right to pose as the critic of the Universities, for it is at least doubtful whether he was at any time a member of either of them. He speaks of himself as educated at Cambridge, but no trace of him can be found in the University registers according to the Dictionary of National Biography. He was ordained in 1632, curate of Kildwick in Craven in 1634, and Master of the Grammar School at Clitheroe in 1643. In the Civil War he seems to have taken the Parliamentary side, and was surgeon

[2] Academiarum Examen, London, 1564.

and chaplain to a regiment in the Parliamentary army, becoming a Noncomformist and being intruded as vicar of Mitton in Yorkshire and also at All Hallows in Lombard-street. He acquired some fame as a preacher, but later on he fell into discredit, for his books were seized in 1657 and he gave up the ministry. Later in life he studied metallurgy and practised medicine. He died at Clitheroe in 1682.

"THE VINDICATION OF ACADEMIES."

Webster's book was answered by John Wilkins and Seth Ward in the "Vindication of Academies."[3] In this defence of the Universities the authors complained that Webster, and even Hobbes, were ignorant of the present state of the Universities and of the grounds of those arts and sciences which they pretended to improve. Surprise is expressed that the Universities should be condemned as rigidly bound to Aristotle and accused of ignoring the modern advances in knowledge which have modified his teaching. On the contrary, all modern ideas were freely discussed—the anatomical and magnetical philosophy and the Copernican astronomy. That both in the public lectures and private classes of the Universities those things which they are accused of neglecting are taught and are well learnt. Particular exception was taken to the criticism which maintained that University teaching is not only useless but harmful to candidates for the ministry, for such academic knowledge "added to the gifts of grace must be only helpful and not injurious."

On the other hand, Webster's praise of the Rosicrucians, of Jacob Boehme and of judicial astrology show him to be a credulous fanatic. Further, Webster is accused of plagiarism, of stealing whole sheets of Gassendi's book, and of being wholly dependent upon those translations to which he had access for his knowledge of foreign writers. The accusation that the study of chemistry was neglected was denied, and with some reason it was pointed out that, the practice of medicine being an art which is based on observation and experience, new discoveries in anatomy do not always involve alterations in practice equal to that in theory, but have often confirmed and established practical rules.

Webster's objection to the use of the term "divines" as blasphemous is treated as ridiculous, but it is conceded that "theologian" is better, and the complaint of the use of the Scriptures in scholastic exercises is inconsistent with the desire expressed that Christian principles should be introduced into the schools of physical learning. Moderns may agree with the contention that students should be taught to use their hands in laboratory work, but there is force in the objection that the wishes of parents must be respected, and that in the sixteenth and seventeenth centuries it was not thought desirable to teach young gentlemen natural philosophy, chemistry, agriculture, or mechanics, but they should be trained to be rational and graceful speakers and fitted to move in polite society.

Webster's critic, John Wilkins, the Bishop of Chester, was one of the most learned and estimable men of that age. He adhered to the Parliamentary side in the Civil War, and was Warden of Wadham College in 1648. He had the reputation of being a wise, beneficent, and tolerant Head of the College, and he may be justly called the founder of the Royal Society. The weekly meetings of the London philosophers, when held in Oxford, took place in the Warden's lodgings. Although siding with the Commonwealth, he preserved the University from the ignorant commanders and soldiers who, unrestrained, would have demolished all places and persons that pretended to learning. He was afterwards appointed Master of Trinity College, Cambridge, where he was greatly honoured and loved, but at the Restoration he was deprived of this post, as it had been long promised to Henry Ferne. He was made Prebend of York and Dean of Ripon. He procured the incorporation of the Royal Society in 1662, becoming its first secretary. He lost his library and valuable MSS in the great Fire of London. He was made Bishop of Chester in 1668 and died in 1672. He is generally supposed to have written the preface to Seth Ward's "Vindiciae Academiarum."

"AN ARK FOR SUBMARINE NAVIGATION."

Bishop Wilkins was interested in many things, and Professor Joly, of Trinity College, Dublin, has recently drawn attention[4] to his little volume, entitled "Mathematical Magic," in which one chapter is headed "Concerning the Possibility of Framing an Ark for Submarine Navigation, the Difficulties and Conveniences of such a Contrivance."

This invention seems to have been produced by a Dutchman named Cornelius Drebbel, who was born in Alkmaar in Holland in 1572, and came to England in 1604, where he secured the favour of James I., and was given lodgings in Eltham Palace. He left England at the invitation of the Emperor of Germany, but was involved in the misfortunes of the Thirty Years War, when he was thrown into prison. Through the intermediation of James I. his release was procured, and he returned to England, where he remained until his death in 1634. He appears to have enjoyed the esteem of his contemporaries, especially of the Hon. Robert Boyle, who refers to him as a "deservedly famous mechanician and chymist."

The great interest to us of Drebbel's work is that he appears to have been much ahead of his contemporaries in appreciating the function of respiration. It is said that he built a ship in which a man could navigate under water from Westminster to Greenwich. In the boat "a person could see under the surface of the water and without candlelight as much as he needed to read in the Bible or any other book." This remarkable ship was in 1645 yet to be seen lying in the Thames or London river (C. van der Oonde). Boyle accepted the testimony of what he called "a few credible persons" that Drebbel could enable men to continue under water without suffocation or even inconvenience, for, as he says, it is "not the whole body of the air, but a certain quintessence or spirituous part of it that makes it fit for respiration, which being spent the remaining grosser body of the air is unable to cherish the vital frame." So that besides the mechanical contrivance of his vessel he had—

"a chemical liquor which he accounted the chief secret of his submarine invention, for when from time to time he perceived that the finer and purer part of the air was consumed or overclogged by the respirations and steams of those who went in his ship he would, by unstopping the vessel full of his liquor, speedily restore to the troubled air such a proportion of vital parts as would make it again for a good while fit for respiration, whether by dissipating or precipitating the grosser exhalations or by some other intelligible way."

According to Boyle, Drebbel kept the nature of the liquor a close secret and justified his own inquiry because the man and his invention were so extraordinary, all the more so, as it was 150 years before the discovery of oxygen by Priestley and Lavoisier and of the part played by it in respiration. It was not until 1681 that John Mayow published his conclusion that respiration and combustion are analogous phenomena. Drebbel must have discovered some means for removing from respired air its poisonous properties, as by drawing it through lime-water to absorb the carbon dioxide, by which it would be possible to prolong the voyage, and the ventilation of the boat may have been assisted by pipes going to the surface, the air being drawn in by fans or pumps. It is certain that the bishop realised the difficulty presented by respiration in the problem of submarine navigation and that he fully appreciated the work of Drebbel in overcoming this part of the problem.

While Harvey failed to grasp the function of respiration and set aside the suggestions that had been made by others under the crude form of the action of "spirits" on the blood, it is quite plain that these contemporaries of Harvey allowed their minds to run farther than his on the chemical side of these questions, and were closer than he to understand the nature of the physiological questions involved. His failure in this respect was probably due to his ignorance of chemistry, which Aubrey says he was wont to undervalue and speak against those who practised its doctrines.

BISHOP WARD.—OTHER CRITICISMS OF THE UNIVERSITIES.

Seth Ward, successively Bishop of Exeter and Salisbury, was a distinguished mathematician, mathematical lecturer at the University of Oxford, and afterwards Savilian professor of astronomy in 1649. He entered as a Fellow Commoner at Wadham when John Wilkins was warden and when the fame of the college attracted many men of eminence. These gatherings probably constituted the nucleus of the Royal Society. After the Restoration he was made successively Prebend, Dean and Bishop of Exeter. He was subsequently translated to Salisbury and became Chancellor of the Order of the Garter. His controversies with Hobbes and Webster

[3] Vindiciae Academiarum. Oxford, 1654.
[4] The Origin of the Submarine, Blackwood's Magazine, July, 1917.

caused him some trouble. He is the reputed author of the "Vindiciæ Academiarum," in which he replied to the criticisms of the Universities which Webster and Hobbes had published in the "Examen Academiarum."

Hobbes, the author of "The Leviathan" (1588–1679), was a somewhat bitter critic of the Universities in his day, particularly on the ground of their adherence to the Aristotelian philosophy and physics. He says, "The philosophy schools through all the universities of Christendom grounded upon certain texts of Aristotle," and these institutions were merely useful as a handmaid to the Roman religion; they rendered no knowledge of the subordinate and secondary causes of natural events or "physiques," but merely empty words. Thus they said that bodies sank because they are heavy or because they desire to be at rest. He also criticised their teaching of the civil law, but although there was doubtless much with which to find fault, he says nothing about the art of medicine or the way in which it was taught.

Dr. C. A. Mercier[5] is of opinion that Paracelsus and van Helmont had much to do with preparing the ground for the reception of Harvey's new doctrine. He thinks that by their bold challenge to the Aristotelian doctrines they rendered it possible for Harvey to state his novel opinions without being regarded as uttering blasphemy, but he is almost as severe a critic of Oxford and Cambridge as was Hobbes 200 years earlier. He quotes a statement of Averroes that Aristotle is "the perfection of truth, that his understanding attained the utmost limit of human ability," and that "it may truly be said of him that he was created and given to the world by Divine Providence, in order that we might see in him how much it is possible for a man to know." This tribute may seem exaggerated to the non-academic mind, but "it would not be considered at all exaggerated in the University of Oxford even to-day." He gives no facts whatever in support of this charge. However, there may be something in what he says, for had not Paracelsus and van Helmont shown that Aristotle could be contradicted without calling down fire from heaven, Vesalius might not have had the courage to publish his discovery of the non-porosity of the cardiac septum.

TEACHING OF MEDICINE AT CAMBRIDGE IN HARVEY'S TIME.

It is not easy to trace any evidence of the teaching of medicine at Cambridge in the time of Harvey. In Vol. III. of Venn's "Biographical History of Gonville and Caius College" (p. 253) we find the following:—

"It will be observed that no reference has been made in the above sketch to any such officer as a medical lecturer. The fact is that though the College had for centuries enjoyed a medical reputation, no trace of any systematic instruction in the subject can be discovered until very recent times. Indeed, the earliest lecturer recorded by tradition is the late Sir George Paget, who is known to have held the office from about 1848 until he ceased to be a Fellow in 1852. Since that date such lecturers have been regularly appointed. The increased scope of the work, owing to the great addition to the number of students, was recognised in 1881, when the title was changed from Medical Lecturer to Lecturer in Natural Sciences and Director of Medical Studies. That some instruction, however, in the shape of what we should now call anatomical demonstration was occasionally given in the College can be proved by one or two interesting facts. In the first place, in the register of the parish of St. Michael—the College lies in the parish—there is an entry of burial under the date April 6th, 1601, of 'Mr. Hutton, the anatomyr of Key's College.'"

Venn took it for granted at first that this gentleman's connexion with anatomy was of the active kind, and that we had here evidence of a very early demonstrator in the College. But it now seems certain that he played the part of the subject, for it is recorded that Dr. Grimston, "one of our Fellows," made a dissection in the College just four days before. That similar instruction was carried on 25 years later seems plain from the statement of Dr. Joseph Mede, that he attended anatomy lectures in "our College." In the register of Great St. Mary's, the parish in which the schools, now absorbed into the public library, were situated, several such entries are found. The earliest of these is in 1566, when it is recorded that "John Figgen mad anotomy at the scholes and buried here, the 12th March." This was during the residence of Dr. Caius, seven years before his death.

[5] Paracelsus and van Helmont: Proc. of Royal Soc. of Med., 1915, vol. ix., Section of History of Medicine.

Professor A. Macalister informed Dr. Venn that this is the earliest contemporary record known to him of the actual performance of human anatomy in England. Again in 1628 there is an entry that "John Smith, a prisoner at the castle that was anatomised, was buried." In a note, Dr. Venn says that it perhaps accounts for the prefix "Mr." to Hutton's name, a title at that time confined by University usage to Masters of Arts and Fellow Commoners, in the direction of Dr. Caius that the burial of such anatomised bodies should be "orderly and reverential."

In the same volume (p. 47) we find the following: "On the same day (Patent Roll, August 1st, 1564) is added the Royal License, for the purchase of the houses from Trinity. A new and very important concession was included in this license. It was a formal grant from the Queen (Elizabeth) of bodies for dissection to the effect that they and their successors shall have for ever, at their free discretion and will, without the contradiction of anyone, two human bodies for anatomy, condemned by law for theft or homicide and dying in the town castle or county of Cambridge. And that they may freely dissect them at their will, with the reverence due to the human body, for the increase of medical knowledge; and this without any payment.' Dr. Caius gave careful directions in his statutes concerning these dissections, desiring that 'every year during the winter there shall be spent by the students of our College, on anatomy and on the worthy burial of the dissected bodies at S. Michael's 26/8. The president and everyone residing in College to attend the burial of the remains with as much respect and ceremony as if it were the body of some more dignified person; and this on account of the advantage they have thus received. And the Master shall see that the students of medicine do not treat the body with any lack of respect or humanity.' It is to be feared that very inadequate use was made of this privilege."

In his "Advancement of Learning" Bacon mentions that the study of medicine was based upon the use of dead bodies for dissection.

It is further evidence that dissection was practised in Cambridge in the seventeenth century that Sir Charles Scarburgh (1616–1694), who was a Fellow of Caius College, published a manual on dissection ("Syllabus Musculorum"), but there appears to have been no dissecting-room, public or private, until after the passing of the Anatomy Act, 1832. Science and its votaries, indeed, found no permanent home at Cambridge in the time of Harvey. Gilbert of Colchester, who, as Bacon says, had made a philosophy out of a loadstone, had been long removed to London, where as Royal physician he enjoyed favour and good fame, and died in 1603. Physiology as a subject did not exist, and the knowledge of the functions of the organs, apart from their structure, was elementary and very often fundamentally erroneous. In spite of Bacon's commendation, morbid anatomy was entirely neglected, perhaps because, as he pointed out, how much more difficult was this study than that of normal anatomy, the latter being presumably uniform in all healthy subjects, while the former presented endless variety. Its difficulty undoubtedly hindered any advancement, for it is not until the second half of the nineteenth century, when fairly complete post-mortem examinations were made on the bodies of all persons dying in hospitals, that the subject became familiar, and morbid appearances grew to be generally known to hospital physicians and were appreciated to a less extent from students.

IMPULSE GIVEN BY HARVEY TO BRITISH PHYSIOLOGY.

There can be no doubt that in the sixteenth and seventeenth centuries those Cambridge men who desired to study scientific medicine could not do so at home, and resorted to the Italian universities to study under such great masters as Vesalius, Fallopius, and Eustachius, whose success was rather in descriptive anatomy than in physiology. Harvey's work was of great importance because, although he added no new facts, he placed a new interpretation on what had been more or less common knowledge for 2000 years, and stimulated an advance in medicine which has continued up to the present time. This advance was mainly due to his employment of vivisection, by which method he laid the foundations of physiology and thereby of the progress of medicine. Physiology has been rightly called the Institutes of Medicine, which must march hand in hand with pathology and be its guide. Its progress depends upon the advance of many sciences, especially of chemistry, in that department which we call organic or physiological. This was a new science 40 years ago, and has been built up

within the lives of many of us. It has opened out a wide prospect and gives promise of revolutionising medical study.

The impulse that the work of Harvey gave to British physiology is shown by naming those who followed him in the next 100 years.

Thomas Wharton (1614–73), physician to St. Thomas's Hospital, studied at Cambridge and Oxford, discoverer of the submaxillary gland and author of Adenographia (1656).

George Joyliffe (1627–58), M.D. Cantab., F.R.C.P., discoverer of the lymph ducts.

Francis Glisson (1597–1677), M.D. Cantab., Fellow and President of this College, author of famous monographs on Rickets and the Anatomy of the Liver.

Thomas Willis (1621–95), M.D. Oxon., F.R.S., F.R.C.P., recognised saccharine diabetes and described the Anatomy of the Brain (the circle of Willis).

Richard Lower (1631–91), M.D. Oxon., F.R.S., F.R.C.P., performed transfusion.

Edward Tyson (1650–1708) and Samuel Collins (1618–1710) were comparative anatomists.

Clopton Havers described the Haversian canals.

William Cowper or Cooper (1666–1759) described "Cowper's" glands.

ADVANCE OF MEDICINE IN SECOND HALF OF NINETEENTH CENTURY.

But it cannot be claimed that at Cambridge or elsewhere there was any real progress in medical education. Here and there men of genius made discoveries, but they were not aided by any organisation, either inside or outside the university or medical school. Men like the Hunters did their work at their own expense, and for many years to come even the teaching of anatomy owed most to what was done in private schools.

The best that can be said for British medical education is that it was based upon some genuine knowledge of practical anatomy and bedside acquaintance with diseases. But it was not until the second half of the nineteenth century that a true spirit of reform entered into the schools. In no place was this more manifest than at Cambridge. Although it is still necessary, and probably always will be, for the Cambridge student to seek clinical experience elsewhere, he may find at Cambridge all that he desires in laboratory opportunities and, under due limitations, for clinical research.

If Cambridge has proved itself worthy of its association with the illustrious Harvey this is equally true of the great hospital of St. Bartholomew's, with which perhaps his professional connexion is more generally recognised. Harvey left Cambridge apparently as soon as he had completed his arts curriculum, taking no part of his medical education there, and although he returned there for his degree, he owes to Italy the instruction that opened the way for his great discoveries.

HARVEY AS PHYSICIAN TO ST. BARTHOLOMEW'S HOSPITAL.

Of his labours as a physician at St. Bartholomew's we know little, and what records remain do not impress us very favourably with the work done in those days by those who held such appointments as that of Harvey. When he was originally appointed he was only obliged to attend once a week, and he was never formally required to visit the wards. The number of patients seen in the hospital must have been very small, for as late as 1749 the numbers are given as—in-patients, male 16, female 15; out-patients, male 50, female 50, each week; and there is no reason to believe that a hundred years earlier they were more numerous.

Apparently the patients were obliged to come to the doctor and not the doctor to the patients, as one of the rules says:—

"It is the duty of the matron and sisters to complain to the doctor if any poor lurk in the house and do not come to him at his sittings or take the medicine he prescribes, but cast it away and abuse it."

It is difficult for us to understand the position of such a man as Harvey holding a post which, to us, seems scarcely likely to afford him any return in the way of useful experience. The salary was inconsiderable, some £20 a year with an allowance for fuel and "livery," but it is possible that the appointment indirectly led to a certain amount of practice, for undoubtedly he made money by his profession, although Willis suggests that his brother Eliab employed the "small capital" accumulated by him during his active years of practice and before the breaking out of the Civil War to such good account that he actually died a rich man. The period during which he may have earned a considerable professional income must have been from about 1607 to 1630.

HARVEY'S LATER YEARS: HIS GIFT TO THE COLLEGE.

After the latter date, when he went abroad with the Duke of Lenox, it is doubtful whether he ever had much opportunity for practice. In 1633 he went with Charles to Scotland, whence he followed him to Oxford (1642), and in 1646, on returning to London, he resigned all his appointments, and as his wife was dead he took up his residence with his brothers Eliab and Daniel. It was then that Harvey felt himself fully justified in making over his paternal estate, then worth £56 per annum, to this College as a free gift during his life and as a provision for the objects of which this annual oration forms part.

He died at the advanced age of 80 on June 3rd, 1657, and I cannot do better than repeat the words of Willis:—

"So lived, so died one of the great men whom God in virtue of his eternal laws bids to appear on earth from time to time, to enlighten and to ennoble mankind."

THE TREATMENT OF

TRENCH FEET AND ALLIED CONDITIONS BY BIER'S METHOD OF PASSIVE HYPERÆMIA.

BY PHILIP TURNER, M.S. LOND., F.R.C.S. ENG.,
MAJOR, R.A.M.C.

(*A Paper read before a Medico-Chirurgical Society, March, 1917.*)

DURING and after a spell of severe weather we have had large numbers of cases, as doubtless all hospitals have had, diagnosed as "trench feet," "frost-bite of feet," and, of course, "I.C.T." feet. This has given me the opportunity of trying Bier's method of treatment by passive congestion in a considerable series of cases, the results of which I propose to bring before this meeting. Though I have had no access to statistics, I feel sure that the relative number of these cases is less than it was either in the winter of 1915–16 or 1914–15. This is doubtless due to the improved prophylactic measures taken, and it is rather suggestive that large numbers of cases come from certain units, while others appear to be almost free. Though prophylactic measures have been attended with so much success, there is, so far as I know, no very satisfactory method of treating cases which have once developed, and I hope that the results obtained by the method of passive congestion will lead to this method being given a more prolonged and thorough trial.

A memorandum on the "Etiology, Prophylaxis, and Treatment of Trench Foot," by Médecin Majors Raymond and Parisot, was circulated to the various hospitals, and a good many of the members of this society will, doubtless, have read it. This memorandum is of great interest and I shall refer to it on several occasions. The actual treatment recommended here consists in the application of compresses of sterile gauze soaked in a solution of powdered camphor and sodium borate in boiled water. This is covered with cotton-wool and impermeable tissue. We have had no cases here in which this treatment has been started before arrival, and we have had no opportunity of starting it here, so I have no practical experience of it; but I must say that I should have expected these cases to do better with a method in which the feet were kept dry rather than with one in which wet compresses were employed.

Causation.

Before speaking about the treatment of trench foot it will be necessary to say something about the causation of this condition and to consider the pathological changes which actually occur. This subject was investigated by Professor Lorrain Smith, Professor James Ritchie, and Dr. James Dawson,[1] who succeeded, by submitting them to cold, wet, and constriction of the limbs, in producing a similar condition in rabbits. Their conclusions may be summed up by saying that they consider the condition to be essentially one of inflammation brought about by direct action of cold on the

[1] THE LANCET, 1915, ii., 595.

tissues, and that histological examination of the affected parts showed that the chief changes took place in the blood-vessels. They regard the influence of infecting micro-organisms as unimportant, and found that when these were present they did not seem to be the cause of the inflammatory process. They also point out that the essential difference between trench foot and true frost-bite is that in the latter the direct action of severe cold leads to the complete destruction of the vitality of more or less extensive masses of tissue, while in the former the effect of cold and wet, combined with certain factors which impede the circulation in the extremities, is to produce this inflammatory reaction.

The view of the pathology taken by Médecin Majors Raymond and Parisot in the memorandum already mentioned is very different. They regard trench foot as caused by a special infection of the foot, and claim to have isolated the infecting agent, a mould, *Scoputariopsis koningii*, which is found in the mud of the trenches, and which penetrates the feet at the site of the grooves at the side of the nails or through excoriations of the skin. They compare trench foot with Madura foot, and regard cold as only of secondary importance in its causation. The suggestion that trench foot is due to a specific infection is, I believe, quite new, and so far we have had no opportunity of searching for the presence of this mould. Captain G. Richardson, R.A.M.C., has, however, in a number of cases of trench foot in which there were sloughs, blisters, or gangrenous areas, examined the discharge bacteriologically, and in all cases found only the usual organisms one would expect to find in such lesions with ulceration of the skin. I do not think that many will agree with Majors Parisot and Raymond that cold and wet are of only minor importance. Indeed, one may go so far as to say that the great majority of medical men who have had charge of these cases, while admitting the importance of other factors, would regard prolonged exposure to cold and wet as the most essential cause of trench foot. As regards there being a special infection by a mould, one can express no definite opinion at present, but must wait further experiments and researches which will doubtless be made to test the correctness of this theory.

At present, then, we may accept the account of the pathology by Professor Lorrain Smith, Professor Ritchie, and Dr. Dawson, but in one respect I am not quite in agreement with their explanation—viz., as to the importance of the part taken by micro-organisms, especially in the more severe cases. In the milder cases, where the symptoms are limited to swelling, congestion, and alterations in sensation, the changes produced by micro-organisms are doubtless unimportant, but in the more severe cases in which one finds septic blisters, sloughs, and ulcers often surrounded by inflamed areas or actual cellulitis, and sometimes gangrenous areas of considerable extent and some depth, the part taken by micro-organisms in their production must surely be of the greatest importance. The discharge from such cases has often a distinctly foul odour, and it was in the discharge from such cases that Captain Richardson found organisms present such as are usually present in, or on, the skin. Another point as showing the importance of organisms in these cases is that tetanus has occurred with sufficient frequency in cases of trench feet as to render it desirable that the usual prophylactic dose of serum should be injected in all cases whether the skin is broken or not.

My view of the pathology of trench foot may be summed up as follows: The condition is primarily caused by prolonged exposure to wet and cold, combined with other factors which impede the circulation. These set up the inflammatory changes described by Professor Lorrain Smith. The vitality of the tissues is lowered to such an extent by this that septic organisms already present in or on the skin, possibly in fissures or excoriations, are enabled to set up more or less severe septic inflammatory processes resulting in the development of blisters, sloughs, and gangrenous areas. Needless to say, this view as to the part played by micro-organisms is derived entirely from clinical observations but some such explanation appears to be necessary to explain the more severe cases. This is a point of considerable importance, for if it is granted that septic organisms play an important part in the process, even though that part is secondary and indirect, their intervention must be taken into account in whatever line of treatment is adopted.

Classification.

It will be convenient here, to facilitate further reference, to arbitrarily divide cases of trench feet into three groups: (*a*) Mild, where the skin is unbroken and the symptoms are swelling and "congestion" (really a bluish discoloration due to hæmorrhagic infiltration of the superficial tissues), combined with sensory disturbances. (*b*) Moderate, where blisters, or small sloughs, or black and apparently gangrenous areas are present, and the sensory disturbances are more marked. (*c*) Severe, where there are extensive sloughs, ulcers, or gangrenous areas of considerable extent involving, perhaps, several toes.

With regard to this grouping of cases it may be pointed out that the changes in trench foot are usually superficial, and that appearances are often very deceptive. It is no uncommon thing to see a patient who appears to have one or more toes completely gangrenous, or to have large patches of apparently deep and spreading gangrene on the dorsum or side of the foot, and yet on treatment such areas shrivel up and separate leaving scarcely a scar underneath. Improvement sometimes takes place very quickly, and in some of these apparently severe cases the freedom from scarring on recovery shows that the deeper layers of the epidermis cannot have been damaged beyond recovery, even though when first seen the condition may have looked so serious as to suggest that amputation of one or more toes would be necessary. I do not, of course, mean to say that gangrene of the toes and massive gangrene of the tissues of the foot never occur, or that amputation is never called for, but I am sure that this is quite rare. When extensive sloughing and gangrene are present I believe that this is largely due to a virulent secondary infection and that early treatment has been impossible.

Method of Treatment.

The question of prophylaxis is of the very greatest importance, but we are now concerned only with the treatment and not the prevention of trench foot. A consideration of the above points will show that treatment should be directed to (*a*) cleansing of the foot and the prevention of secondary infections, and (*b*) the treatment of the original inflammatory changes and also of any secondary infection which may have developed.

(*a*) *Cleansing of the foot.*—The importance of this is very rightly insisted upon by Major Parisot and Major Raymond, who recommend "a careful cleansing, almost a surgical cleansing," with special soft soap containing camphor and sodium borate. The method I have adopted has been as follows. The feet are cleaned with ordinary soap and water and the nails are also cut and cleaned. The feet are then painted over with a solution of 1 per cent. picric acid in methylated spirit, and this application is repeated at first daily and later on alternate days. This solution, which I have used and recommended from the early days of the war for the purpose of sterilising the skin in military surgery, is most efficient. It penetrates to the deeper layers of the epidermis and never causes dermatitis or irritation of the skin. Having been treated in this way the feet are wrapped in sterile gauze and left exposed to the air until the patient finds that they are more comfortable when covered by the bed-clothes.

(*b*) *Treatment of the inflammatory processes.*—Bier's treatment by passive hyperæmia is recognised as a satisfactory method of treating many conditions where there is a subacute or chronic inflammation. It is also very often successful in the treatment of chilblains. These considerations led me to try Bier's treatment for trench feet. It is applied as follows:—

As soon as the cleansing process has been carried out a constricting bandage is applied just above the knee. A Martin's elastic bandage cut in half provides a bandage of about the right length and strength. If this is not available, an elastic crêpe bandage may be used, but these are not so satisfactory, as they stretch, and the pressure exerted may diminish or even disappear after a few hours. For the first day the bandage is kept on for 18 hours. It is then removed and reapplied after an interval of six hours. It is then again applied, and on the second and succeeding days is left on for 22 hours in every 24. The bandage should in all cases be applied just tightly enough to impede the venous return, but on no account must it obstruct the arterial supply. In many cases there will be no alteration in the appearance of the limb, but in some there will be noticed a slight increase in the swelling or the leg below the bandage may feel slightly

warmer as the result of the congestion. The treatment should be painless and any complaint of pain—not slight discomfort—is an indication for the removal of the bandage. I have only had one case in which this was necessary, and even here the bandage was subsequently reapplied without any further complaint of pain.

Results.

It will now be as well to describe the effect of the treatment. It has been pointed out that sometimes there is a temporary slight swelling of the leg below the bandage. This soon disappears, and in slight and moderate cases the swelling of the foot has usually quite disappeared in 24 or 48 hours. In severe cases it may persist for longer. Pain improves rapidly, and in 24 hours has either disappeared or has markedly diminished. Anæsthesia improves steadily, but not so rapidly. In a moderate case with anæsthesia of all the toes and of the greater part of the dorsum of the foot the sensation will probably be normal in four days, with the exception of blisters and gangrenous spots where the sensation is naturally still deficient. In cases of moderate severity blisters and the gangrenous areas shrivel, dry up, and eventually separate, leaving an unbroken delicate pink skin underneath. This process is very interesting, and not infrequently there is an extensive desquamation of the skin of the affected part, sometimes of practically the whole foot. In extensive cases, after the separation of dried blisters, gangrenous spots, and epithelial scales, there is left a surface of thin, pink, soft skin resembling a baby's foot. This is naturally very tender, and though the patient can walk in soft shoes, boots cannot be worn until the thin skin has become hardened and accustomed to pressure. I cannot help regarding this desquamation and separation of dried gangrenous areas as part of the natural process of cure in these cases of moderate severity, and I think that the treatment by passive hyperæmia considerably accelerates the process. The following is an example of a case in which this occurred.

Rifleman W. F. C. Admitted Jan. 27th, 1917, discharged March 10th, 1917. On admission both feet were affected about equally. There was severe burning pain, especially at night, and anæsthesia of all toes and about half of the dorsum and sole of both feet. The third and fourth toes of the right foot were very discoloured and appeared gangrenous, as was also the little toe of the left foot. There were several other small black spots. There was slight œdema and also congestion of both feet. The patient was unable to walk. Bier's treatment commenced on Jan. 27th. Pain disappeared in 24 hours, also the swelling of the right foot, but the œdema of the left foot persisted for four or five days. By Feb. 4th both feet were practically normal, and dried-up sloughs were beginning to separate from the toes. The bandages were omitted and the patient got up. There was no swelling, but some pain on walking. On Feb. 5th he was kept in bed, and the bandages were reapplied with immediate relief, and as he had a cold with pyrexia he was kept in bed till the 10th. He then got up again and walked well without pain. The gangrenous spots separated on Feb. 12th, leaving unbroken skin beneath. From that date the patient did very well. There was extensive desquamation of the congested parts of both feet, so that on the anterior half of the dorsum, including all the toes, the skin, though unbroken, was thin, pink, and very tender. He could walk quite well in soft shoes, but was unable to wear boots. As it would be a long time before the skin would be sufficiently hardened to enable him to wear boots, and as his age was only 16, he was evacuated to England. Owing, however, to another attack of pyrexia he was not evacuated until March 10th.

In slight cases, as soon as pain, swelling, and anæsthesia have disappeared, usually after four or five days, the patient is allowed to walk in soft shoes. Then after two days boots are worn at first for half an hour daily. This period is gradually increased until the boots can be worn for two hours without discomfort, when the man is discharged to the convalescent depôt. In "moderate" cases the procedure is the same. The patient is allowed to walk as soon as possible in shoes, and is then gradually accustomed to boots. A longer period is, however, required before walking is possible and before boots can be worn. A large proportion of these cases (I should estimate about 50 per cent.) have improved sufficiently to be discharged to the convalescent depôt, but in many of the men, especially where there has been extensive blistering or many gangrenous spots with much desquamation, the feet are so tender that several weeks must elapse before they return to even light duty, rendering evacuation necessary. When the patients are sufficiently convalescent to get up the Bier's treatment is still continued, the bandage being removed when they get up and replaced when they go to bed, so that the bandage is applied for about 18 hours out of the 24. "Severe" cases always require evacuation to England, for, even under the most favourable circumstances, it must be many weeks before these men are fit to return to even light duty. These cases have also been treated in the same way, but owing to pressure on the hospital accommodation it has not been possible to keep any under observation for more than two weeks. Even in this time, however, there has been rapid improvement. Swelling, pain, and anæsthesia diminish, sloughs and gangrenous areas rapidly dry up, lines of demarcation form, granulating surfaces assume a more healthy appearance, and surrounding areas of inflammation subside. Thus even in these severe cases the symptoms rapidly diminish and the natural process of cure is hastened.

It may be asked whether the improvement in cases treated by Bier's method is really due to the Bier's treatment and not to the rest, general treatment, and picric acid application. That it is due to the former is proved by the results in some cases where one foot has been severely, the other only slightly, affected. The bandage has only in these cases been tried for the severely affected foot, while the other treatment has been applied equally to both. In such cases one nearly always finds that the foot treated by Bier's method is in a couple of days better than the other more slightly affected foot, which has not been so treated. In conclusion, I would point out that the treatment is simple and painless and requires no special apparatus beyond the bandage.

ON THE

TREATMENT OF A SERIES OF RECENTLY INFLICTED WAR WOUNDS WITH FLAVINE.

(A REPORT TO THE MEDICAL RESEARCH COMMITTEE.)

BY HAMILTON DRUMMOND, F.R.C.S. EDIN.,
AND
J. W. McNEE, M.D. GLASG.,
CAPTAINS, ROYAL ARMY MEDICAL CORPS.

With an Introduction by
Surgeon-General Sir ANTHONY BOWLBY.

INTRODUCTION.

THE report by Captain Drummond and Captain McNee is the result of a very careful study of the effect of flavine in recent wounds. It is evident that the number of cases dealt with is not sufficient to enable final conclusions to be drawn, but some of the observations are sufficiently definite for the formation of very definite opinions, and I am in complete accord with those expressed by the authors.

In the first place, it appears evident that flavine does not sterilise recent wounds, and that various bacteria grow freely in wounds treated with it.

Secondly, it appears to cause a very superficial necrosis, of the formation of a fibrinous membrane, if applied in the strength of 1 in 1000.

Thirdly, in spite of the presence of bacteria, there is a notable absence of inflammation and of septic infections, and in the cases observed there were no bad examples of gas gangrene, although anaerobic organisms were present in many wounds in large numbers.

Fourthly, healing by granulation is very slow, and the growth of granulations is evidently checked by the presence of flavine.

As far as the present series of operations goes it is clear that it does not bear out some of the claims made for flavine as a bactericidal agent or as to its harmlessness to the tissue cells. But it appears to be a useful application in the form of gauze soaked in the solution when used as a first dressing to large open wounds, and it seems to limit the power for harm of the pathogenic bacteria and to prevent the inflammation of the tissues which is usually caused by bacterial invasion. Further observation of many more cases is required to establish its value in the treatment of recent wounds.

(Signed) ANTHONY BOWLBY,
Surgeon-General.

G.H.Q., July 25th, 1917.

REPORT.

Towards the end of April a sample of flavine was placed at our disposal by Surgeon-General Sir Anthony Bowlby, to be tested in the treatment of recently inflicted wounds at the Front. The test has been carried out partly in a casualty clearing station and partly in an "advanced surgical centre," situated about four miles behind the lines. Almost all the cases were operated upon, and the treatment with flavine commenced within twelve hours after the injury; in many instances, indeed, only four or five hours had elapsed before the wounds were dealt with. All the wounds were therefore in the pre-suppurative stage, in contrast with other tests reported from home. It has been possible, through the courtesy of Lieutenant-Colonel Frankau, commanding officer of the clearing station, to keep a number of the cases under observation for several weeks, thus greatly aiding the observation on the process of healing in the wounds and the investigation from the bacteriological side.

Strength of solution employed.—The flavine was at first employed in a strength of 1 in 1000, the dilution being made in normal saline solution, in which the powder is readily soluble. This strength was used both for the primary stages and for the subsequent treatment by irrigation or otherwise. This routine was soon given up, however, as it was found that equally good results ensued if the use of 1 in 1000 solution for the first dressing was followed by the employment of a solution of 1 in 5000 for all subsequent applications. In some cases, also, where the Carrel method of irrigation was being used, the strength of the solution was further reduced to 1 in 10,000.

Number of cases and number of wounds treated with flavine.—In this test a series of 70 cases have been under treatment, but as many of the men had multiple injuries, the series comprises over 120 wounds. In some cases as many as six serious wounds were present in the same patient. The vast majority of the wounds were caused by the fragments of shells or bombs, only about eight injuries from rifle or machine-gun bullets being encountered while the test was in progress.

Classification of the wounds.—The wounds may be divided into three classes, both for easy reference, and because the method of treatment differed in each class: (1) Flesh wounds, including all injuries to soft parts, without damage to bone; (2) compound fractures; (3) miscellaneous wounds of special parts—abdomen, chest, head, and joints.

Surgical methods adopted.—These naturally depended on the type of injury met with. Long incisions, with free excision of damaged muscle and fascia, must be regarded as a cardinal part of all operative treatment in recent wounds, no matter what subsequent methods are employed. After this preliminary surgical treatment the wounds treated with flavine were dealt with in the following ways:—

1. Primary suture.—This method was employed in 30 cases, all being wounds of the soft parts alone. In the majority of these, the damaged muscle removed at operation was examined bacteriologically, and shown to be infected. Fragments of cloth, and dirt, were also commonly removed from the track of the wound.

2. Drainage by tube or gauze strip, followed by secondary suture.—This was carried out in 10 cases.

3. The Carrel method of intermittent irrigation.—The perforated tubes were irrigated with the flavine solution every four or six hours. This method was chiefly employed for compound fractures and deep or extensive muscle injuries.

4. Gauze packing in open wounds.—This was found very useful in the treatment of many extensive wounds where the Carrel method was not readily applicable; for instance, in certain types of compound fracture and in amputation stumps where complete closure was impossible.

The gauze packing, soaked in flavine, could be left *in situ* for several days without changing the dressing.

Results of Treatment with Flavine.

1. *Cases treated by primary suture.*—Wounds treated by excision of the infected and damaged tissue, followed by primary suture, gave excellent results. In a series of 30 wounds of this kind only two broke down. In a test such as this it may be well to give brief details of the two unsuccessful cases.

CASE A.—A fragment of shell passed through the thigh from side to side, fracturing the femur and causing much comminution of the bone. At the operation, four and a half hours after the injury, many completely detached fragments of bone were removed, along with much damaged muscle. The wounds were then thoroughly washed out with 1 in 1000 flavine solution and completely closed up on each side of the thigh with silkworm gut. On the second day after the operation the patient looked ill and was febrile. On examination the wounded thigh was swollen and the skin showed a patch of discoloration near the wound. A second operation was thereupon performed, the sutures on the outer side of the thigh being released, allowing a quantity of brownish fluid, which contained abundant anaerobic bacilli, to escape. Four Carrel tubes were inserted into various parts of the wound and six-hourly irrigation with flavine was commenced. No spreading gas gangrene developed and the subsequent course of this case was uneventful.

CASE B.—This was a case of severe multiple wounds of the left thigh and buttock. There was an entry wound 2 inches above the natal fold, close to the ischio-rectal fossa on the left side, but no exit wound. At operation the missile was seen to have tracked downwards into the thigh. The popliteal space was swollen, and on making incision the missile, a fragment of shell of considerable size and embedded in cloth, was removed. The track of the missile was laid open in its whole course down the thigh, revealing much damage to the hamstring muscles. All possible damaged muscle was resected, and after washing well with 1 in 1000 flavine the wound was completely sutured without drainage. Three days later the wound gave way in its middle third, and grumous fluid, containing many organisms, escaped. Under an anæsthetic the wound was widely opened up in its middle third, to show areas of necrotic muscle which had been left behind at the first operation. Free drainage was ensured, and the patient was able to be evacuated to the base a few days later; doing well.

In contrast to these two unsuccessful results, one of the 28 successes may be quoted to show in what variety of wounds primary suture was possible.

CASE C.—A soldier was admitted with a severe shell wound of the right buttock. The entrance wound was near the sacrum, and the exit below and behind the great trochanter. The track measured 8 inches from end to end. At the operation, six hours after injury, the track was found to pass through the fibres of the gluteus maximus in all its extent. The track was laid open, and several fragments of cloth, with much damaged muscle, were removed. After arresting hæmorrhage the wound was washed with 1 in 1000 flavine and completely sutured. The wound was dressed on the third day and was perfectly sound. The patient was evacuated to the base at the end of a week, sent to England on the ninth day, and after removal of the stitches on the thirteenth day was able to walk about.

This case is especially interesting, as such wounds of the buttock often develop gas gangrene. The fragments of cloth and pieces of damaged muscle removed at operation were both infected with anaerobic bacilli.

2. *Cases treated by drainage, followed by secondary suture.*—Secondary suture gave good results in all the 10 cases in which it was adopted. It may be remarked here that in several instances the secondary suture was completed while the wounds were far from being bacteriologically sterile, but no untoward result followed. The edges of the skin, however, in wounds which have at first been left open and stitched up later do not heal as in primary suture. Healing takes place more slowly and a considerable induration can always be felt along the track of the wounds. The stitches, moreover, must be kept in position much longer than usual, and we have found that if they are removed before about the fourteenth day the edges are liable to give way.

3. *Open wounds treated with flavine.*—In this group are included both wounds treated by the Carrel method and those simply packed with gauze soaked in the antiseptic. In open wounds, which form the major portion of our series, observations on the rate of healing and on the bacterial flora have been most readily carried out, and they have therefore received considerable attention. The typical progress of an open wound treated either by the Carrel method or by the gauze packing may now be described, taking as a concrete example a flesh wound of the thigh where a considerable area of skin and muscle have been blown away, so that the wound was left open to granulate. On removal of the first dressing on the third day the wound, except for being deeply stained with flavine, has undergone no alteration in its appearance whatever, and resembles an injury only a few hours old. All signs of inflammation are wanting, and there is no pain, redness, swelling, or induration in the tissues around. The secretion from the wound is minimal in amount and suppuration is absent. The complete absence of suppuration, even

in wounds where films show abundant organisms to be present, is a very noteworthy feature in wounds under treatment with flavine. When dressed again at the end of a week the skin edges are found clean cut, no epithelial growth having taken place from the edges. The floor of the wound has by this time become covered by a closely adherent membrane, only detached with difficulty from the underlying structures. This yellow pellicle forms over whatever tissue is exposed in the wound, whether it be muscle or subcutaneous fat. Its histological structure will be referred to later. The wound from this time onward, if flavine be continued, remains in a stationary dried-up condition, showing neither signs of inflammation nor of repair. Even after a fortnight or more only small and scanty granulations can be discovered by peeling off the membrane which covers them.

It is obviously improper treatment to continue the application of flavine until such a stage is reached, and experience has shown that a wound heals with much greater rapidity if the flavine be stopped after three or four days in the case of small wounds, and after about a week in the case of severe wounds or compound fracture. If at this period eusol be substituted the yellow membrane comes away piecemeal within a day or two, and granulations appear more luxuriantly. In a very few days later growth of epithelium is well established at the edges of the wound. The wound, in short, changes its character entirely. Abundant discharge of purulent nature, containing always a great number of organisms, makes its appearance, and rapid healing occurs.

4. *Wounds of the chest, abdomen, head, and joints.*—These cases have formed such a small part of our series that no conclusions of value for this report can be drawn from them. It is of interest, however, to note that quite considerable quantities of flavine solution can be left in the abdominal or thoracic cavities without inducing the least toxic effect.

Histology of Wounds Treated with Flavine.

Portions of tissue have been removed from the edges or floor of seven open wounds under treatment with flavine and examined histologically. These examinations were made 2, 2½, 3, 8, 8, and 11 days after treatment had begun.

Up to three days the skin edges were sharply cut and unaltered histologically. The floor of the wounds showed a thin layer of fibre and polymorphonuclear leucocytes, covering a narrow zone of necrosed muscle fibres. Between the dead fibres polymorphonuclear leucocytes were fairly abundant, and in one case many large Gram-positive bacilli of the usual anaerobic type were present in the same situation and within the necrotic fibres themselves.

The material taken from a wound five days old showed a thicker covering layer of fibrin and leucocytes, with a few dead muscle fibres embedded in it. This layer, which is bright yellow in colour before fixation, is obviously from its structure composed chiefly of fibrin, although it does not give perfectly the characteristic reaction with Weigert's stain. No evidence of granulation tissue production was observed, and the skin at the edge showed no epithelial proliferation.

The tissue from two cases taken on the eighth day gave information of considerable interest. In one case wedges of skin and subcutaneous tissue were removed from open wounds on the abdominal wall and on the forearm, in which muscular tissue was involved. Both of these wounds were in a dried-up condition, and showed to the naked eye no signs of inflammation or repair. This was borne out under the microscope, epithelial proliferation from the edges of the skin being minimal in amount. The floor of the wounds was covered by the usual membrane of fibrin and leucocytes, and in one wound there was distinct evidence of early granulation tissue production in subcutaneous fat. In the other case a portion of the vastus externus muscle exposed in a large wound of the thigh, communicating with a compound fracture, was removed for examination. The whole floor of this wound was covered with a very dense yellow membrane, firmly adherent to the deeper structures. In the segment removed for examination this membrane was 2 millimetres in thickness. It was also noted that the subcutaneous fat underlying the membrane at one part of the wound had been stained bright yellow by the antiseptic dye, while the muscle remained unaffected. Below the membrane in this case granulation tissue production was evident throughout, forming a comparatively thin layer. The edge of the skin in this wound was examined.

The tissue taken from the wound eleven days old showed no new features. Granulation tissue production was well established below the yellow pellicle, but there was little epithelial ingrowth from the edges of the wound.

Bacteriology of the Wounds.

Except in the cases where primary suture was adopted most of the wounds were examined from day to day. As a routine films were made and stained by Gram's method, and both aerobic and anaerobic cultures were set up to amplify and control the observations in films. In this way a fairly complete examination of 90 wounds has been made.

A small number of the wounds remained sterile from the outset. These were cases in which it had been possible to remove all damaged and infected tissue at the time of operation, and all of these wounds were soon closed by secondary suture. It may be said at once, however, that in the great majority of the wounds no sterilisation in the bacteriological sense was brought about by the application of flavine. The wounds tended to pass through, as regards their bacterial flora, the stages now well recognised in wounds of this war. Infection by anaerobic bacilli was very common in the early stages, but tended to pass off at the end of about a week, except in the case of compound fractures, where the infection generally continued as long as the wounds remained under observation. After a few days invasion of the wounds by streptococci was almost the rule, accompanying, and often gradually replacing, the anaerobic infection. Later, generally after a week or longer, infection with a variety of other organisms was commonly met with, especially staphylococci, *B. pyocyaneus*, and a variety of short coliform bacilli. The coliform bacilli require special notice because of their frequency and also because of their marked resistance to flavine, as borne out by test-tube experiments (*vide infra*).

The broad conclusion arrived at from the bacteriological observations was that the type of infection in wounds treated with flavine in no way differed from that met with in cases where other treatments had been employed.

A point brought out incidentally was the fundamental difference between what may be termed "surgically sterile," as distinct from "bacteriologically sterile," wounds. Complete bacteriological sterility was rarely obtained, yet the patients were obviously doing well, and the wounds showed no signs of local or spreading inflammation. In several instances secondary suture was adopted with complete success, while numbers of organisms were still recognisable in the field of the microscope. Cultures, moreover, showed that these organisms were still viable.

"In vitro" Experiments with Flavine.

A few test-tube experiments, using various organisms freshly isolated in culture from wounds in our series, have been carried out by Captain J. Shaw Dunn, R.A.M.C., to control these done elsewhere. The tests were made in tubes containing 4·5 c.c. of glucose broth and 0·5 c.c. of varying dilutions of flavine. Each tube was inoculated with 0·1 c.c. of a 24 hours glucose broth culture of the organism under examination. This technique, with minor modifications, served for the examination of both aerobic and anaerobic organisms. The following results were obtained:—

1. *Staphylococcus aureus.*—Vigorous growth in tube containing 1 in 80.000 flavine. No living organisms in tube containing 1 in 10,000 flavine.

2. *Streptococcus pyogenes.*—No visible growth in tube containing 1 in 100 000 flavine. No living organisms in tube containing 1 in 100.000 flavine.

3. *Streptococcus fæcalis.*—Visible growth in tube containing 1 in 100.000 flavine. No living organisms in tube containing 1 in 50.000 flavine.

4. *B. perfringens*, two strains. The same technique was adopted here as in the other tests, except that the tubes were incubated in an "anaerobic can" in the absence of oxygen. Vigorous growth in tube containing 1 in 200 000 flavine. No living organisms in tube containing 1 in 100.000 flavine.

5. *Coliform bacilli*, four similar strains from different cases. Vigorous growth in tube containing 1 in 400 flavine. Living organisms recovered from tube containing 1 in 100 flavine.

A second series of tests, in which the dilutions of flavine were made in fresh human serum, were carried out with one

strain of a coliform bacillus. The technique was briefly as follows:—

0·45 c.c. of fresh unheated human serum was placed in each of a series of small tubes, and 0·05 c.c. of varying dilutions of flavine were added, so as to give final dilutions in the serum of 1 in 100 up to 1 in 80,000. To each tube was then added 0·025 c.c. of a 24 hours' glucose broth culture of the bacillus. The tubes were then incubated for 24 hours, at the end of which time the organism had grown abundantly in a control tube containing serum alone.

Result: Vigorous growth in the 1 in 20,000 dilution in serum; no living organisms recovered by subculture from the dilution of 1 in 8000 in serum.

This set of experiments bears out the enhancing power of serum on the action of flavine and also shows that of all the organisms tested coliform bacilli are the most resistant to the action of the antiseptic.

A further test was made to ascertain whether the enhancing power of serum on flavine was lasting or the reverse.

Five small tubes, each containing 0·45 c.c. of fresh human serum, were made up to 0·5 c.c. with flavine, so as to give a dilution in each tube of 1 in 5000 flavine. These tubes were inoculated with a coliform bacillus at varying intervals up to 90 hours after the flavine and serum were mixed together. Subcultures were made from each tube 24 hours after the culture of the organism had been added. No growth was obtained in any of the tubes, showing that the mixture of flavine and serum had retained its antiseptic power for at least 90 hours.

Conclusions.

1. Flavine appears to have many advantages as a *primary* treatment of recent war wounds. Among the advantages are:—(*a*) The absence of all toxicity, even in large wounds. (*b*) The prevention of suppuration and of spreading sepsis, as brought out in our series of test cases. (*c*) The primary dressing need not be changed for two or three days, and is then easily and painlessly removed. This may be of great advantage during severe fighting where rapid evacuation of wounded from front to base is required without unnecessary dressing of the wounds. (*d*) The wounds are not inflamed or painful, and the surrounding skin is never irritated.

2. Emphasis must be laid on the fact that excision of damaged tissue and mechanical cleaning of the wound are necessary preliminaries to the use of flavine.

3. Flavine cannot be classed as a success in the treatment of the *later stages* of war wounds. The wounds tend to assume a stagnant condition, during which the processes of repair are almost in abeyance. After a few days, when the danger of gas gangrene and of spreading sepsis have to a great extent passed off, flavine should be stopped and another treatment adopted.

4. In the majority of cases war wounds are not rendered bacteriologically sterile even by the prolonged use of flavine.

5. Test-tube experiments carried out with organisms isolated from actual wounds bear out the strong antiseptic properties of flavine, and their enhancement in the presence of serum. Coliform bacilli, which are a common infection in the later stages of wounds, are much more resistant to the action of the antiseptic in test-tube experiments than any of the other types of organism examined in this way.

Colonel R. J. Blackham, C.I.E., D.S.O., A.M.S., at present serving as A.D.M.S. of a division in France, was elected a member of the Society of Apothecaries of London at the annual meeting of the society held at the Apothecaries Hall, Blackfriars, on Oct. 9th.

Dr. George Wallace Eustace, of Arundel, has been placed on the commission of the peace for West Sussex. He is at present on active service in France, and he served in the South African War. He is a former mayor of Arundel.

NATIONAL HOSPITAL FOR THE PARALYSED AND EPILEPTIC.—Founder's Day is to be celebrated at the National Hospital, Queen-square, London, W.C., on Friday next, Nov. 2nd, when the wards will be open to inspection from 3 to 6 P.M.

ETHER-OIL ANÆSTHESIA BY THE RECTUM.

BY H. M. PAGE, F.R.C.S. ENG.,

ANÆSTHETIST TO THE KING GEORGE HOSPITAL, GUY'S, AND THE WEST LONDON HOSPITALS.

With a Note by

G. B. MOWER WHITE, M.B., M.S. LOND., F.R.C.S. ENG.,

SURGEON TO THE KING GEORGE HOSPITAL, GREAT NORTHERN CENTRAL HOSPITAL, ETC.

WE owe this method of producing anæsthesia to Dr. James T. Gwathmey,[1] of New York. Before the beginning of the war I had anæsthetised a good many cases by this method and had come to rely on it entirely for operations on the thyroid gland if hyperthyroidism was present. Since 1914 I have used it for the wounded in cases of plastic face and jaw operations. Some fatalities have occurred in this particular class of case under the ordinary methods of anæsthesia. I therefore suggest the more frequent use of Gwathmey's method, which is simple, easy, and, I believe, safe.

Description of Method.

The apparatus required is very simple: An indiarubber catheter; a funnel; a medicine measure; an empty medicine bottle with a cork, to shake the mixture in—this shaking must be done forcibly for two minutes. The following is the technique I employ:—

A simple wash-out of the bowel an hour or two before the injection, in addition to the usual preliminary dose of medicine, is an advantage, but can be dispensed with if necessary. A subcutaneous injection of morphia gr. ¼, atropine gr. 1/100, is given half an hour before the time fixed for the ether-oil injection. I have used the paraldehyde rectal injections, but prefer morphia subcutaneously. From 20 to 25 minutes before the time of operation 6 ounces of a mixture containing two parts of ether to one of oil (ether 4 ounces, oil 2 ounces) are slowly run into the rectum. Six minutes are spent in making this injection. The india-rubber catheter is passed 3 or 4 inches into the rectum, never more than 4 inches.

When the operation is finished the remaining ether-oil must be washed out, using a large rectal tube and funnel. The wash-out must be done thoroughly and methodically, as on this depends the rapidity with which the patient recovers consciousness. I do the washing out, unless I have shown a nurse how to do it. The tube is gradually passed up and as much as possible of the remaining ether-oil mixture with-drawn. The tube is then drawn down again near the anus, and some water or saline is run in and siphoned off. This is repeated gradually higher up the bowel until no oil or ether can be detected in the returning fluid, when the tube is gradually withdrawn lower and 3 ounces of olive oil are passed in and left there. The temperature of the water or saline must not be above that of the rectum—in fact, only the chill off.

Following the use of this technique there have been no rectal, pulmonary, or gastric sequelæ. The return of con-sciousness is not delayed when the washing out is done satisfactorily.

Soldiers, unless they are very ill, are resistant to the effects of ether, and there is also the loss of ether in the breath, from the venous blood as it passes through the lungs, so that to procure a full anæsthesia in a reasonable time it is often necessary to administer a little ether with a Clover's apparatus and allow some re-breathing; if preferred, ether by the open method or some A.C.E. can be given. If it has not been possible to give the injection 20 minutes before the time for operating some anæsthetic vapour by the mouth will certainly be necessary for induction to prevent delay. After surgical anæsthesia has been produced nothing more will be required by the mouth in a large number of cases. The anæsthesia obtained is quiet and even and the laryngeal reflex is present. In some cases an occasional whiff of chloroform must be given in the usual way with a Junker's apparatus, but of course much less chloroform is required than with the usual methods, and there is the continual even stimulation from the ether absorbed from the rectum, so that with ordinary care there is practically no increased danger.

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[1] THE LANCET, 1913, i., 1756.

Cases in which the Method has been Employed.

I have used this method in face, mouth, and nasal operations 17 times; they all made uninterrupted recoveries, and there were no rectal or other sequelæ. This is not a large number of cases in itself, but I have used ether-oil rectal anæsthesia in 47 cases altogether. The operations in which I have used this method are as follows: Plastic operations on the face, operations on the jaw, radical cure of antral disease, œsophagoscopy, bronchoscopy, laryngoscopy, removal of nasal septum, cholecystotomy, cholecystectomy, gastrostomy, gastroenterostomy with partial gastrectomy, exophthalmic goitre, laminectomy, trephining, appendicectomy, amputation of the breast.

All these 45 cases recovered from the operation except 2. These 2 cases were laminectomies; they died some time after the operation from ascending myelitis. In 2 of my early cases, in which a 75 per cent. solution of ether was used, there were rectal irritation, mucus, and a slight trace of blood lasting a day or two. In another case there was looseness of the bowel for a couple of days; since then I have never used a stronger solution than 2 to 1, as recommended above.

One of the cases of appendicectomy was in a lady aged 75. She had lately suffered from influenza with pulmonary complications; her heart was weak and dilated. Acute appendicitis—appendicectomy—uninterrupted recovery.

Another, a boy, aged 11, with perforated appendix. Appendicectomy. I gave him 5 ounces of equal parts of ether and olive oil. He made an uninterrupted recovery.

The patient in one case of amputation of the breast was a big, very fat, elderly woman. She was suffering from asthma and chronic bronchitis. The complete operation was done. Recovery was uninterrupted. There was no effect whatever on her pulmonary condition.

I should say that post-anæsthetic vomiting is less frequent than with other methods. Pain is not complained of during injection when a 2 to 1 solution is used. I do not know if it would be safe to put the patient into the Trendelenburg position when using this method. I have never done so, and I have not seen any reference to this position in the American literature on the subject. Mr. Mower White, who operated in the majority of the plastic cases, has kindly added the following note.

Note by MR. MOWER WHITE.

Mr. Page has asked me to add a few remarks to what he has written concerning the administration of ether per rectum. I have seen this form of anæsthesia used in a considerable number of cases and for many different operations. All the patients have been adults. The results have been uniformly good both as regards the condition of the patient during the operation and as regards the absence of untoward symptoms afterwards.

In operations upon the face and mouth, to which Mr. Page refers, there can be no doubt that ether administered per rectum is a far safer anæsthetic than is chloroform vapour by inhalation. Certainly in those cases upon which I have operated we have not had a moment's anxiety with regard to the condition of the patient, while at the same time the degree of anæsthesia has been sufficient for all that was required. In these operations, too, the absence of apparatus for delivering an anæsthetic confers greater freedom upon the actions of the surgeon and is a welcome relief. Most of the operations have occupied an hour, some even an hour and a half, and the anæsthesia has remained good until the end. Many of the patients were sick once after the operation, but I have seen no case of repeated vomiting.

As regards the rectum, no trouble has arisen in any of my patients, and there has been no evidence of irritation of the rectal or colic mucous membrane. I attribute this absence of symptoms to the fact that a very thorough washing-out of the bowel has been practised as soon as possible after the operation is finished. The lavage is continued until the water returns almost clear, certainly free from the odour of ether and from visible globules of oil.

In a few instances I have recommended this mode of anæsthesia for patients suffering from chronic bronchitis and needing operations. These patients took the anæsthetic well and were none the worse for it.

A CARTILAGE PROSTHESIS FOR THE EYE.

BY J. L. AYMARD, M.R.C.S., L.R.C.P. LOND.,

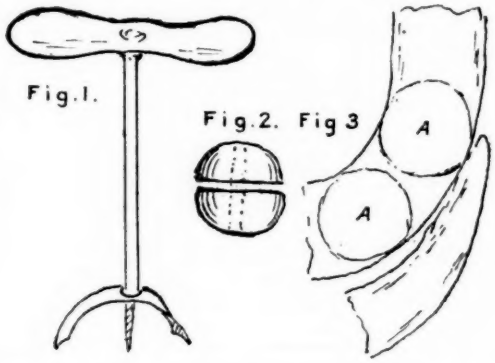
CAPTAIN, R.A.M.C. (TEMP.); QUEEN'S HOSPITAL FOR FACIAL INJURIES, FROGNAL, SIDCUP, KENT.

THE failure of the artificial eye from a cosmetic point of view depends upon two main factors, immobility and depression. The former condition is due to the absence of a mass of tissue fitting inside the artificial glass casing, and the latter to the fact that a sphere has been replaced by a shell.

However much ophthalmic surgeons may differ as to the value of metal or glass prosthetic globes, plastic surgeons in general would, I feel confident, agree with me that there can be no question as to the superiority of the use of natural tissues. With this object in view, I am now employing spheres constructed from the costal cartilage.

Since my investigations regarding the vascularity of cartilage I can, with the utmost confidence, understand how cartilage transferred, rapidly establishes fresh communications with the blood-vessels in its new vicinity and becomes fixed to the capsule in a recent enucleation or to the surrounding tissues in older standing cases.

Fig. 3 illustrates the portion, A A, of the eighth costal cartilage from which two hemispheres are trephined. These



(Fig. 2) are then either pegged with cartilage or fixed with catgut.

In primary enucleations, provided there is no sepsis, the surgeon places the cartilage sphere inside Tenon's capsule and sutures the same. He then proceeds to suture the conjunctiva. Whilst the ophthalmic surgeon is enucleating the eye the second surgeon can, with practice, produce the sphere of cartilage.

Whether cartilage spheres can be introduced into a septic eye socket or not remains to be seen, but from experience in other directions I am inclined to think that it is worthy of extensive trial as the resisting power of cartilage to sepsis in nasal cases is remarkable.

Fig. 1 gives a diagrammatic view of the trephine I use. The object of this trephine is not only to cut each hemisphere circular, but to shape it at the same time. The two points of the trephine have cutting edges, each made to cut in the same direction; the central pin is fixed and gimlet-shaped.

MEMORIAL TO THE LATE MR. CHAUNCY PUZEY, F.R.C.S.—On Oct. 10th, the anniversary of his death, a memorial service was held in the chapel of the David Lewis Northern Hospital, Liverpool, when a tablet was unveiled and a chancel-rail dedicated to the memory of the late Mr. Chauncy Puzey by the Rev. J. Bell-Cox, who paid a warm tribute to the work and influence of the deceased. The tablet was inscribed:

"To the memory of Chauncy Puzey, F.R.C.S., Surgeon and Consulting Surgeon to this Hospital 1875-1916. This tablet is erected by the committee and his colleagues in recognition of his long, valued, and devoted services. Died October 10th, 1916."

Medical Societies.

MEDICAL SOCIETY OF LONDON.

Modern Artificial Limbs and their Influence upon Methods of Amputation.

A MEETING of this society was held on Oct 22nd, Sir STCLAIR THOMSON, the President, being in the chair.

Mr. E. MUIRHEAD LITTLE and Major R. C. ELMSLIE, R.A.M.C., introduced a discussion on Modern Artificial Limbs and their Influence upon Methods of Amputation.

Major ELMSLIE said that when the hospital for fitting artificial limbs was started at Roehampton in the summer of 1915 the supply was inadequate and the types available were by no means perfect. The limbs demonstrated represented a series of typical examples of the work at Roehampton. The arms represented an immense mechanical advance upon the very elementary types which were available at the beginning of the war. The function of an artificial leg was to give good stability in standing and walking and a natural gait. Hence the important points were the way in which weight was borne upon the leg, the way in which the leg was built to secure stability, and the way in which the knee and ankle were controlled. A stump might take its bearing either upon its termination (end bearing) or upon the bony prominences around the proximal joint. In general, end bearing, either complete or partial, might be expected when the bone section was through cancellous bone, when the bone was covered with thick skin and muscle or fascia, and when the skin over the stump was itself naturally adapted to weight-bearing. The type of end-bearing stump was, of course, that given by Syme's amputation. The other bearings used should be those upon the tuberosity of the ischium and upon the head of the tibia. Although a certain amount of bearing might be taken by fitting the stump tightly and so getting circumferential pressure upon it, yet this must not be trusted to any great extent, as by this method the skin was apt to be stretched tightly over the end of the stump, and if the scar was terminal or the skin thin this might result in ulceration. Major Elmslie then described the points in the fitting of a limb for amputation through the thigh. This limb was generally suspended by a sling over the shoulders, the lower end of which was attached to the leg below the knee, either directly or by passing over a pulley. In this way it acted as a knee-extending mechanism. In short stumps, however, a pelvic band was necessary to enable the stump to remain securely in the bucket and to control the limb. The mechanism used to extend the knee was of two sorts. The older one was a spring, either of rubber or of steel, which should act in such a way that the knee was only extended by it from the right-angled position. If it acted from a position of greater flexion than this it would prevent the man from sitting comfortably with a flexed knee. The second method was the sling from the shoulders, which pulled upon the front of the leg-piece when the shoulders were raised or when the weight of the swinging limb was put upon it, thus extending the knee. The stops which limited the movement of the knee in both directions must be so strong as to be unbreakable, even when the whole weight of the body exerted its maximum leverage upon them. In the ankle mechanism the present limbs almost all differed from the Anglesey leg in that the movement allowed at the ankle-joint was small in range (only about 20 to 30°), and this movement was stopped by the compression of springs, usually of rubber, but sometimes of steel. The small range of movement was found not to interfere with walking. Correct building of the limb was essential if stability was to be secured. Two points were essential: (1) The axis of the knee joint must be behind the line which represented the centre of gravity of the body when it was erect, and (2) the foot must be mounted in slight equinus (20°) and must be prevented from reaching the right-angled position. The routine material for the construction of artificial legs was still willow, and as a rule the thigh and leg pieces were constructed of single pieces of wood, appropriately hollowed out, the joints being made of steel. It was not an advantage to have very lax joints in an artificial leg. As a rule the joints were lined with a bushing of leather, by adjusting which they could be made stiffer. Hip-joint amputations were fitted with a leather cup which entirely enclosed the stump, fitting it very accurately. This was attached to the trunk by a steel pelvic band, and to it was attached the limb, by a hinge joint on the outer side, and on the inner side by a steel piece which runs around on a quadrant situated upon the under surface of the leather cup. It was possible by placing the hip-joint far forward and the knee-joint far back to fit a limb which was stable with both hip- and knee-joints free, but it was customary to fit locks to both these joints, so that the man might walk with one or other free. In amputations through the knee the lower end of the stump was larger than the part higher up, therefore the front of the bucket must be cut away and filled in by a piece of leather or else an entire leather thigh-piece must be used. In either case the leg-piece was attached by outside steel joints. For amputations below the knee a wooden bucket was accurately fitted to the head of the tibia and below the patella. The weight should be borne upon these points, although in exceptional cases it might be necessary to fit a leather thigh bucket reaching right up to the tuberosity of the ischium and taking a bearing there. In short stumps a partial end bearing could often be taken by stretching a shelf across the bucket at the right level. In some cases it was difficult to stop the stump rubbing up and down in the bucket during movement at the knee-joint, but this could be got over by fixing a leather socket closely to the stump and inserting this into the bucket. As a rule the leg was suspended around the thigh by a leather corset with lateral steels hinged at the knee. When a man had worn a leg for some time, however, he could often dispense with this, having the leg attached only by a narrow band of leather fastening above the knee, to which the leg was hung by lateral straps. If this was done the foot should not be adjusted with too much equinus, as the equinus position of the foot tended to force the knee into a hyperextended position. A Syme stump was fitted into a leather bucket strengthened with steels on either side and in front, and preferably lacing behind. The ankle-joint worked against two rubber buffers as in the other types of leg. It was possible, however, to replace this mechanism by a tendon stop at the back and an anterior accumulator, and this method must be used in Pirogoff and Chopart stumps. Many other materials besides willow were now being tried, such as leather, plied wood, wood shavings and glue, celluloid and duralumin. A type of leg for a thigh amputation, which would not give way under the weight of the body when the knee was flexed, had been recently invented but was still on its trial. In general, an artificial arm should be designed to take the place of the left arm in work and must be adapted to the particular needs of the man. Movements could be transmitted to it by tension being put upon cords. In this way three pulls could be exerted: (1) by expansion of the chest; (2) by rounding the shoulders; (3) by elevation of the shoulder. These cords could be used to activate the elbow-joint, to lock and unlock this joint, and to work a mechanical hand or appliance used in its place. An arm for amputation above the elbow should be attached by a harness which passed over the shoulder, but this should limit the shoulder movements as little as possible. The arm and forearm parts should be connected at the elbow by a hinge-joint with a lock, which fixed it securely and prevented movement in either direction. The alignment of the elbow-joint need not be the true one, as it was more useful for it to flex more across the chest. In *the mechanical arm* the elbow was flexed by a cord usually activated by the pull given by rounding the shoulders. In this arm the forearm piece had the shape of the natural arm and ended in a wrist plate to which the hand or other appliance could be attached. In a *worker's arm* the forearm was represented by a skeleton of steel, usually a rod, to which appliances could be attached. If a man who had such an arm for work wished to have a nice looking forearm and hand, he could adjust a show piece representing these over the skeleton. These two types of arm, the mechanical and the worker's, could be combined by making the elbow mechanical but using a skeleton forearm. For amputations below the elbow a simple socket was used connected to an arm corset by lateral steel joints, or in the case of long stumps by lateral leather straps. In a new arm made by Williams, of Swansea, the elbow was kept permanently slightly flexed, the socket was fitted to the forearm

stump and held on by a continuation upwards of firm leather which laced around the condyles of the humerus, giving a very secure hold for a working arm. In wrist amputations and other amputations low down in the forearm it was important to preserve the movements of pronation and supination. It might be possible to do this by omitting the steel joints at the elbow, or the movement could be secured by the pronation arm made by Hobbs, in which ball and socket joints allowed the forearm socket to rotate upon the elbow. For working men appliances fitted to the wrist-plate were generally more useful than a hand. The number of appliances made might be divided into the following classes: (1) Simple hooks, rings, and grips, without movement; (2) similar appliances in which there is mobility in one or more directions representing wrist movements; (3) grips opened or closed by the pull of a cord from the shoulder. Many of the appliances invented by Adams, Hobbs, and Anderson would be seen on the arms worn by the men present. The hand was not so useful in mechanical work as the appliance, but for men in professional work a good hand was an essential. In most cases the hand supplied was a simple one, with a spring-grip to the thumb, and often with the ring and little fingers curved into a hook and reinforced for carrying. But mechanical hands were possible and useful for certain men. The first essential in a mechanical hand was that the grip should not be a simple spring grip, which would always be forced by a very slight leverage from without; the mechanism should be such as could not be forced except by breaking the hand. Such a mechanism had been invented in a very simple and light form by Hobbs, and adapted to a number of different shaped hands. In order that the hands or appliances might be removed at will and replaced by others it was essential that they should all be detachable, and for quick detachability the screw method was being replaced by others. In addition to the makers named above the following had examples of their limbs at the demonstration: Messrs. Rowley, Hanger, and the Essential Limb Co., for lower limbs; and Messrs. Blatchford for arms.

Mr. MUIRHEAD LITTLE said that the chief duties of the lower extremity were to support the weight of the body at rest and in motion, and to act as the propellent force in the process of locomotion. End pressure and leverage were the strains to which it was most exposed. The upper extremity was mostly employed in prehension and traction—functions to which the foot of boot-wearing man was a stranger, and end-pressure therefore was not one of the most important strains to which it was exposed, while leverage was all-important. In both the upper and lower extremities provision had to be made to maintain the appliance in place when in action and also, when at rest, against the action of gravity. Weight was borne (*a*) by direct pressure of a part of the body downwards, such as the end of the stump or of a convenient bony process, such as the tuberosity of the ischium; or (*b*) by oblique pressure, when the artificial socket formed a more or less conical cavity into which a conical portion of the body fitted. These two were often or generally combined. Leverage was exerted by the lateral surface of the stump pressing against the side of the surrounding socket. An ideal amputation stump should be as long as possible; it should be covered by sound, moveable, soft parts; and the scar should be placed in a position where it would not be exposed to pressure, and it also should not be adherent to the bone. It should have enough muscles attached to it to move it with adequate force and no inflamed or hypersensitive nerve ends should be palpable in it. The end or ends of the bone or bones should be rounded so as not to hurt the soft parts under them, and the blood-supply should be free and the skin well nourished. Consideration and experience of modern artificial limbs led to the conclusion that, except in the cases of the hip and shoulder, exarticulations were to be avoided, and that amputation through the limb segment above the joint was to be preferred. In the lower extremity a stump capable of bearing some at least of the body-weight on its end should be aimed at. Every pound of pressure here meant less pressure on other parts, which in some cases did not bear it well. An analysis of the records of 549 cases of amputation of the lower extremity seen recently at Roehampton showed that the stumps in the lower third of the thigh are much more sound than those in the upper and middle thirds, which latter region was the seat of nearly half of the total number (43 per cent.). In the upper extremity the question of end pressure did not arise and here the condition of the lower part of the anterior and external surfaces of the stump was of most importance, because these surfaces had to take much of the pressure of the leverage action on the bucket. Many arm stumps with large adherent guillotine scars covering the end of the bone had been found to be quite satisfactory in practice. The presence of osteophytes was rarely any hindrance. These were seldom large except in the thigh and then they were usually situated about the femoral insertions of the adductor muscles which were not exposed to much pressure. The different sites of amputations called for special consideration. Speaking of the upper extremity he said that a forequarter amputation gave no choice of flaps. The resulting scars would generally bear a properly moulded shoulder cap and an artificial arm with some movements. In exarticulation at the shoulder the lines of scar should avoid the clavicle and the prominent bony ridges of the acromion, &c., for on these the shoulder cap must press. Amputations in the upper third of the arm offered very little hold for the socket of an artificial limb. Owing to the arrangement of the muscular attachments around the joint the upper three inches of humerus, or even more, were unavailable, and as in the arm of average length the upper third was only a little over four inches long, very little was available even in an amputation at the junction of the upper and middle thirds. A good deal could be gained by removing wholly or in part the folds of the axilla—i.e., the pectoralis major and the teres major. This had been done with good result and seemed to be an operation worth doing in suitable cases. The latissimus dorsi had not been interfered with so far as he knew. It was less in the way than the other two muscles. A gain of one inch of stump here was of the very greatest value, and as large adherent scars covering the end of the bone were comparatively unobjectionable in the arm, the surgeon in amputating above the middle of the shaft of the humerus should save as much bone as possible, even though there might not be skin enough to cover it completely. The drag upon the adherent scar which gave trouble in the lower extremity is seldom complained of in the upper, owing to the absence of much upward thrust. The objections to amputations through joints in general applied to the elbow in particular force owing to the shape of the bones. If it was impossible to get a forearm stump extending at least an inch and a half below the insertions of the tendon of the biceps, amputation above the condyles of the humerus was to be preferred. The action of the biceps tendon which tended to throw off the bucket when it contracted in flexion was one of the chief difficulties in these short-forearm stumps. Unfortunately, this tendon could not be spared, and its removal was out of the question. The remains of the bellies of the flexor muscles, however, were of no use, and had been removed in some cases with more or less advantage, enabling a better grip on the stump to be obtained. The middle third of the forearm gave good stumps, but the lower third was not a favourable site. Many stumps were cold and cyanotic and the skin tightly stretched and adherent. Moreover, the ends of the bones were often tightly soldered together by fibrous tissue or even bone, and the movements of pronation and supination were lost. Below the wrist it was worth while to save the carpus and base of the metacarpus if possible, provided movement was preserved. The short stump thus formed could be used to actuate a movable thumb with considerable force by means of a simple appliance. If one active finger or a thumb were left it was easy to fit a stump to which it could be opposed, and thus to give the picking-up action and the power of holding a pen. In the lower extremity he considered that exarticulation or amputation through the neck of the femur was better than amputation in the upper third of the thigh. The short stump was unable to move the lever formed by the thigh bucket with sufficient force, no matter how light the limb might be. Such improvements had been made in fitting what was rather inaptly called a *tilting table* that patients who had tried both the ordinary thigh bucket and this appliance usually declared that the latter was much the best. The middle third was the site of nearly half the amputations of the lower extremity treated recently at Roehampton. In this region the objects aimed at should be a non-adherent scar behind the bone and a good disposition of the muscular masses on the inner side. If the great adductor muscles were allowed

to retract too much a too conical stump resulted, and the bunch of soft parts at the top of the thigh just below the pubes formed a serious obstacle to the fitting of a socket. The tendons and fasciæ should therefore be sutured if possible over, but at least near to the end of the bone. The lower third of the thigh, just above the condyles, offered the best thigh stump for fitting with an artificial limb. If a long anterior flap was made, even though there might be an adherent scar behind the bone, a good end-bearing stump often resulted. If the patella could be securely fixed to the end of the bone so much the better. The general objections to exarticulations applied to the knee-joint. In the leg below the knee the most favourable site was the lower part of the middle third. With skilled fitting, however, even very short stumps were useful. Amputation in the lower third of the leg seldom gave a satisfactory stump. The bone surface at the end was too small for good weight-bearing, and the skin was often badly nourished, cold, and cyanotic. Syme's amputation was deserving of its great reputation. If properly done it gave a painless weight-bearing stump. The bones should be sawn through well above the internal malleolus so as to avoid too bulbous a stump, and care should be taken to make the section at right angles to the long axis of the whole leg and not at right angles to the often incurved lower fourth; otherwise a varus stump was likely to result. Too low a section left no room for a s[illegible]og transverse ankle-joint, and a too voluminous heel-flap meant an unsightly artificial foot and boot. Of Pirogoff's amputation experience at Roehampton was small and unfavourable. If the os calcis was not united to the tibia by bone it would sooner or later tilt over and cause pain, and in any case the stump was too long for the fitting of the best type of foot. Chopart's amputation gave a good bearing surface, but generally the calf muscles pulled up the heel and tilted the lower end downwards, and painful pressure on the scar resulted. The stump was too short to give a spring to the gait, and it was well-nigh impossible to fix any prolongation on to it.

Speaking of operation cases sent over from France, Major JOCELYN SWAN asked whether the speakers considered that the secondary amputation should be performed at once while the limb was still in a septic condition, or whether it should be postponed till healing had taken place.

Lieutenant-Colonel D. ELCUM, I.M.S., asked how long an artificial limb would last, and whether the parts of a limb which were worn out could be renewed by anyone except a skilled maker.

Mr. MUIRHEAD LITTLE said that the secondary amputation should be done as late as possible. An artificial leg would last about seven years, but probably something would require to be done in about a year and a half. Arms had only been in existence about two years, so it was not known how long they would last. Many of the men who came back to Roehampton after six months were those who had used them for very hard work. Centres for repair were being started in provincial towns, which would save the trouble of coming to London.

Major ELMSLIE said that the longest time an arm had been in use was one year. He considered that the fitting of an arm was only the first part of the business. The man should then be trained to use his arm in a general way, and later to make use of it in a special way, according to his particular trade or occupation.

LONDON DERMATOLOGICAL SOCIETY.—A meeting of this society was held on Oct. 16th, Captain W. Griffith, the President, being in the chair.—The President announced that Dr. Morgan Dockrell, who was the first president of the society, had presented a collection of books on dermatology which was to form the nucleus of a permanent library for the use of the society.—The opening address of the session was given by Dr. Leonard Williams, entitled "The Real Dermatology."—The following clinical cases were shown:—Dr. J. L. Bunch: Two cases of Rodent Ulcer, the lesion being situated on the left orbit in the one case and on the left cheek in the other case.—Dr. Morgan Dockrell: A case of Epithelioma supervening on Lupus Erythematosus.—Dr. W. Knowsley Sibley: A boy who had suffered with Pityriasis rubra pilaris for seven years and was just developing an attack of Guttated Psoriasis.—The President: A case of Xanthoma Multiplex, also a case of Multiple Lupus in a boy who had exactly 80 distinct lupus nodules present.

Reviews and Notices of Books.

Diseases of Occupation and Vocational Hygiene. Edited by GEORGE M. KOBER, M.D., LL.D., Washington, D.C.; and WILLIAM C. HANSON, M.D., Belmont, Mass. Philadelphia: P. Blakiston's Son and Co. 1916. Pp. 918. Price $8.

ANY contribution to the literature of diseases of occupation is to be welcomed, particularly at the present time. The latest addition is the work of many American authors, with contributions by Sir Thomas Oliver and Dr. T. M. Legge, of England, and Professor Dr. L. Devoto, of Milan. The editors, Dr. George M. Kober and Dr. William C. Hanson, in their foreword set out that their aim has been "the presentation of the basic data concerning the diseases of occupation in such a way as to render them available not only to physicians, but also to employers, employees, efficiency experts, public health officials, and legislators." With this object in view the work has been divided into three parts: Part I. deals with the Specific and Systemic Diseases of Occupation, Part II. with the Causation and Prevention of Occupational Diseases and Accidents, and Part III. deals with Statistics and Legislation bearing on Occupational Diseases. Each part is divided into chapters and sections, and the references, which are numerous and valuable, are given at the end of each section. Some degree of repetition is inevitable in a work contributed by many authors, several of whom deal with the same subject from a different aspect, but in future editions unnecessary repetitions should be reduced.

Part I., which deals with the Specific and Systemic Diseases of Occupation, includes the more common forms of industrial poisoning, such as poisoning by arsenic, brass, lead, mercury, &c. Lead poisoning is fully described, but we cannot agree with Dr. H. Linenthal, who contributes a section on the early diagnosis of lead poisoning, that a history of exposure to lead justifies the diagnosis of lead poisoning in patients presenting obscure symptoms which otherwise cannot be explained. We notice that throughout the section on lead poisoning by Sir Thomas Oliver no reference is made to the valuable experiments carried out by Mr. Kenneth Goadby as to the effect on animals of ingestion and inhalation respectively of lead dust. These experiments show that lead is far more poisonous when inhalaled than when absorbed in any other way, a point to which Sir Thomas Oliver omits to draw attention.[1] Poisoning by the inorganic gases and diseases of the chemical industry in general are not so fully dealt with as we think this important branch of industry deserves. On the other hand, a section is devoted to a rare form of disease—viz., poisoning by manganese. Similarly a section describing the effects on health produced by diminished atmosphere in ballooning and aviation, by Dr. Kober, shows the scope of the work.

Systemic occupational diseases are dealt with in two chapters—Chapter I., Dust Diseases of the Lungs, by Sir Thomas Oliver; Chapter II., Diseases of the Blood, Circulatory System, and Kidneys, by Dr. Thomas L. S. Leigh. There does not seem to us to be much advantage in describing the symptoms, pathology, and treatment of diseases such as acute and chronic endocarditis and acute and chronic nephritis in a work of this nature. The subjects are treated shortly, and we cannot find that a short epitome of these diseases is of value to the medical reader, who can study the subjects in detail in medical text-books. To the non-professional reader a little knowledge of symptoms and treatment may, we feel, be a source of danger, and this is a treatise which makes a fair appeal to a lay public. Occupational diseases of the Nose, Mouth, and Throat, and of the Eye and Skin, are dealt with by separate contributors. Occupational Diseases and Injuries of the Eye, by Dr. Würdemann, occupy another chapter, and here, for example, we think that the subject cannot be dealt with at sufficient length to enable the instruction and conclusions to be of practical value For the diagnosis of foreign bodies within the eye Dr. Würdemann suggests the use of the giant magnet. He states, however, that this method of examination is somewhat dangerous. We entirely agree with this statement.

[1] Lead Poisoning and Lead Absorption, Legge and Goadby. London. 1912.

and would suggest that such a method can only be safely employed by a skilled ophthalmic surgeon. Occupational affections of the skin by Dr. Brown, of Boston, considered from the point of view of the various trades and callings, shows the variety of occupations which produce skin affections, and deals with such widely different occupations as housemaids, musicians, and surgeons. An attempt to include all who are likely to be affected by skin diseases has, we think, tended to crowd out some workers in the more important industries where such diseases in acute and severe forms are commonly met with. Little or no mention is made of dermatitis affecting workers in the nitro-derivatives of benzol or toluol. A chapter on cancer and occupation is of interest, and includes effects produced by exposure to X rays and radium. Part of this chapter is occupied with a brief description of the theories as to the causation of cancer, contagion and house infection, &c. We hardly think such a study comes within the scope of the work.

Part II. deals with the Etiology and Prophylaxis of Occupational Diseases and Vocational Hygiene. Dr. Kober, one of the editors, contributes largely to this part. Much of his contribution is in the nature of a résumé on personal hygiene, and again we have a protest to utter against redundancy. We do not in any way minimise the value of personal hygiene in the prevention of occupational disease, but the omission of a consideration of this subject on general lines would in no way diminish the value of the essay. The subsequent sections of this part deal with the various industries and industrial poisonings, and special accidents attaching to them. Much of this is in many instances a repetition of Part I. Some contributors briefly outline the various processes of manufacture in which industrial poisoning is to be met. A few deal with the special preventive measures applicable to the various industries. We notice the brief reference to poisoning by trinitrotoluene and tetrachlorethane. In view of the importance which poisoning by these substances has assumed, we feel sure the subject will be more fully dealt with in future editions. One section is devoted to the subject of vocational hygiene of the liberal professions, public service employees. Several tables, one giving a list of industries and the poisons likely to be met with in each, and a series of mortality and morbidity statistics complete Part II.

Part III., the Relation of Hospital and Medical School Work, Statistics, Government Study and Legislation to Occupational Diseases, includes an interesting chapter by Professor L. Devoto, of Milan, in which he describes the Milan Clinic for Occupational Diseases. This should be read by all interested in occupational diseases and should prove an incentive to other countries to follow the lead given by Italy. Frederick L. Hoffmann, LL.D., contributes a chapter on the mortality from pulmonary tuberculosis and dusty occupations. The value of this chapter is diminished by the absence of a more definite analysis of the various dusts dealt with, but it contains a valuable lesson by showing the high rate of mortality from pulmonary tuberculosis among workers in dusty industries. A chapter on the use and the fallacies of statistics may be of interest and serve as a preliminary study to those who have no knowledge of the subject but who wish to take an intelligent interest therein. The remainder of Part III. is concerned with legislative measures and the notification of occupational diseases.

We congratulate the editors on the result of their work, which is well illustrated throughout.

Text-book of Ophthalmology. By Hofrat ERNST FUCHS, Professor of Ophthalmology in the University of Vienna, Authorised translation by ALEXANDER DUANE, M.D., Surgeon Emeritus, Knapp Memorial Hospital, New York. Fifth edition. London and Philadelphia: J. B. Lippincott Company. 1917. Pp. 1067. Price 30*s.*

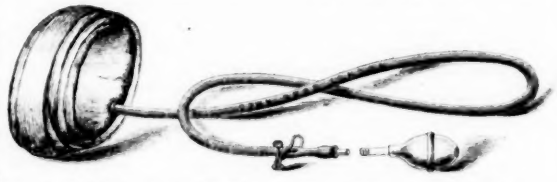
IN previous reviews of this work we have always expressed the opinion that it is the best of the larger text-books of ophthalmology. In the presence of several excellent competitors it can only retain this proud position by keeping well abreast of the times. The new (fifth) edition not only sustains but enhances its high reputation. Though Dr. Duane is very careful to distinguish his additions to the original by the use of square brackets, they are so ubiquitous that it is difficult to apportion the author's and the translator's contributions. A rough estimate indicates that the latter is responsible for nearly half the book. In previous editions the joins in the mosaic have been very evident. In this edition, in spite of the brackets, the welding is very much more satisfactory. Another great improvement consists in changes in the arrangement of the original text. The many pages of remarks in fine print, which were formerly massed as an appendix at the end of chapters or major divisions, and whose considerable value and interest were thus obscured, have been split into shorter sections, each placed in direct juxtaposition to the portion of the text to which it relates. Considerable additions have been made to the chapters on glaucoma, diseases of the retina, and disturbances of motility, and to the sections on refraction, accommodation, and operations. Dr. Duane's well-known interest in ocular paralyses is given perhaps rather too free play, somewhat to the detriment of proper balance. On the other hand, some of the chapters on operations might be still further elaborated with advantage. Other important additions deal with tuberculin and vaccine therapy, the visual field and colour testing, the mapping of scotomata and the blind spot, the etiology of iritis, suppurative choroiditis, retinitis exudativa, and so on.

The book is an admirable exposition of the subject and is well adapted for advanced students. We think, however, that it has reached the limit of size suitable for a text-book. Any further additions should be thoroughly incorporated, and room should be made for them by careful compression of the existing text.

New Inventions.

A PNEUMATIC TOURNIQUET FOR AMPUTATIONS AND OTHER PURPOSES.

SEVERAL years ago I had made a pneumatic tourniquet resembling the one used by Mr. R. H. Jocelyn Swan for intravenous injections. In this case, however, the tourniquet is adapted for use in amputations and in the arrest of severe hæmorrhage from the limbs. It has the two additional advantages that it is easily sterilised and can be easily controlled by an anæsthetist standing at the head of the patient. The tourniquet consists of a rubber bag two inches wide and some 20 inches in length (for use with adults). Halfway along one edge of the bag is inserted the inlet tube T-fashion. The inlet tube is 4 feet long and ends in a stout bulb. The bulb is fitted with a valve, as in the Riva-Rocci apparatus, and a simple spring clip. The



bag is fitted in a sterilisable cover and has a lead back to prevent rolling when distended, this improvement being originally suggested by Colonel A. Fullerton. In use the bag is wrapped round the limb, the inlet tube passing towards the head. A 2½-inch linen bandage is then firmly applied over the tourniquet and the bag inflated till the distal pulse disappears. In the course of an amputation, when all bleeding points have been secured the anæsthetist, by manipulating the valve-end, can release the pressure, pumping up again if bleeding recommences. In operating on patients with brittle arteries less damage will be done by this tourniquet than by any other, because the pressure is only just sufficient to compress the artery, and can be released immediately the artery is tied. This tourniquet should prove useful in the transport of wounded when there is fear of hæmorrhage. The bag and bandage can be applied beforehand, the actual inflation being all that is required if the emergency arises. In this case one inflates till the bleeding stops, a proceeding which could be left to a comparatively inexperienced person.

The makers are Messrs. Down Brothers, of St. Thomas's-street, London, S.E.

J. V. FIDDIAN,
Captain, R.A.M.C.

THE LANCET.

LONDON: SATURDAY, OCTOBER 27, 1917.

The Position of Practice under the National Insurance Act.

A CONFERENCE of Representatives of Local Medical and Panel Committees of Great Britain was held in London on Oct. 18th under the auspices of the British Medical Association. A year had gone by since the last Conference, and some of the points at issue then were found to have been cleared up, while the focus of interest has shifted in regard to others. The perennial difficulty in grasping the working of the "central pool" has remained in spite of the persuasive memorandum issued by the Insurance Commissioners, and the recent Conference decided without hesitation to ask the Commissioners to allow six representatives of the Insurance Acts Committee of the British Medical Association to assure themselves, with the aid of an actuary, that all the money received on account of medical benefit did really find its way into the medical practitioners' pockets. In this connexion the existence of "inflation" of the panel list and its effect on medical accounts was fully recognised, being understood more readily in view of the growing familiarity with the process in other departments of life. Admittedly there is less inflation in the case of munition centres than in other areas, but no action was taken in the direction of pressing for preferential treatment of panel practice in urban areas. The Conference was unanimous in wishing to be assured that the total pool was correct, but was not squeamish about its distribution. On the contrary, a keen sympathy was expressed with the difficulties of the rural practitioner, which are at their greatest in Scotland (cf. p. 656). During the year a Rural Practice Subcommittee has been at work considering the special hardships of rural panel practice. Two of these hardships have been sadly accentuated during the past 12 months. The discharged service man in the country cannot attend personally at his doctor's dispensary, but must be visited, it may be at a great distance. The cost of petrol has gone up by leaps and bounds without corresponding increase in the mileage allowance. The rural practitioner's time is as valuable as that of his colleagues, and whether or no the mileage allowance covers the out-of-pocket expenses of his journeys, he has at all events to bear unrequited the expenditure of time involved.

The Conference confirmed by an overpowering majority the decision of the Insurance Acts Committee of the British Medical Association in regard to the payment for attendance on the disabled service man by visit instead of on a capitation basis. In so doing there was apparently no intention of reversing the doctrine that the capitation fee is the ideal system for medical treatment of an insured population. Under whatever other treatment—specialist, training, re-educational—the disabled man comes, the capitation fee, if it does nothing else, ensures his surveillance by his own family doctor. The arrangement was regarded by the Conference, as by the Insurance Acts Committee which made it, in the light of a temporary expedient in order to elucidate the question whether the disabled soldier is likely to be a more considerable charge on the practitioner's time and skill than his average panel patient. Since the decision was made, however, various factors have come in to complicate the situation. With some of these we deal on pp. 655-6. Treatment by general and V.A.D. hospitals of disabled men as out-patients, if it becomes the general policy of the Pensions Ministry, may result in taking this work so completely out of the hands of the practitioner that the fees earned per visit may work out, in fact, less than a capitation fee on the old lines, and this whatever may be the decision of the voluntary staffs of hospitals in regard to their own remuneration. The principle of the capitation fee was, indeed, vindicated by the unanimous vote of the Conference to empower the Insurance Acts Committee to press for an increase of the capitation fee to a sum of 10s. per insured person, this sum to cover increased liabilities in regard to discharged sailors and soldiers, as well as all services now rendered to tuberculous patients by panel doctors. The steadily increasing cost of living and of carrying on practice makes this decision a logical one, in spite of the attitude taken up a year ago not to press the matter on patriotic grounds. The increased cost to the Insurance Commissioners of raising the capitation fee was stated to be about half a million pounds, the increase implying a rise of 43 per cent. on the panel practitioner's present income, or an addition of £3 per week on a panel of 1000. It is to be hoped that this rise may equitably solve even the difficulties of the rural practitioner in regard to mileage and petrol.

The scheme for collective bargaining drawn up by the Insurance Acts Committee of the British Medical Association, as well as its application of the principle during the past twelvemonth, met with the general approval of the Conference, although a small but vocal section expressed its dissatisfaction with the representation of its views by the Committee, not on personal grounds but on the basis of political expediency. It was argued that negotiations affecting the panel service should be carried on by direct representatives of the statutory panel committees, and that for this purpose an association of panel committees or a panel medico-political union would be more appropriate than a committee of the British Medical Association. This movement is an interesting one for a more stringent trades unionism within the medical profession at a time when the Labour Party itself has just taken the step of extending the basis of its representation, and it may not be unfair to compare the constitution of the British Medical Association with that of the reconstituted Labour Party. The

divergence of opinion on the part of this section of the Conference did not prevent it being perfectly clear that the Insurance Acts Committee of the British Medical Association commands the confidence and support of panel practitioners in general. The Committee is not directly under the control of the Association, the present Conference has chosen half of its elected members, and its constitution can still be further amended. The Committee has earned approval by consistent endeavour to further the interests of the medical profession at large, and by its efforts to consult the constituency on all important negotiations whenever delay did not endanger the successful carrying through of these negotiations. Collective bargaining has become an approved method in panel practice with the Insurance Acts Committee as the bargainer.

New Limbs for Old.

THE early weeks in the installation of a new head at the Pensions Ministry are justifying its claim to be regarded as a Ministry of Restoration. The Statutory Pensions Committee which bequeathed to the Ministry its well-organised Local Pensions Committees found prime difficulty in the fact that the great dearth of labour made it possible for almost every discharged man to get work without training; and the men therefore generally did refuse training and went to work without. The new Ministry has been concerned to make such generous terms with disabled men undergoing treatment and training that military compulsion could not have been a more potent inducement to them to become effective workers. In an admirable article in the October number of "Recalled to Life," the editor, Lord CHARNWOOD, relates his own conversion to this view, and his general survey of the whole subject of disablement will serve to clear the minds of a wide circle of readers. The practice of orthopædics has received further impetus from the visit of the American orthopædic surgeons under the leadership of Dr. JOEL GOLDTHWAIT, of Boston, and from the institution by the Pensions Ministry of an experimental institute to evolve appliances to help disabled men.

The problem of designing artificial limbs which will really assist men in their work was the subject of an important discussion this week at the Medical Society of London. Major R. C. ELMSLIE dealt chiefly with the designing and fitting of artificial limbs on the basis of the work at Roehampton. He showed typical examples of this work, which represents an immense mechanical advance on pre-war methods. Mr. E. MUIRHEAD LITTLE devoted his remarks chiefly to the adaptation of amputation stumps to the artificial limbs they were designed to carry. End-pressure and leverage, the two important factors to consider, have quite different values for the upper and lower limbs. Artificial limbs for the lower extremity are a comparatively simple matter, their use is limited and definite: all that is required is that the appliance shall be strong and reasonably light, that it shall give good stability in standing, and that the gait shall be natural. Prosthesis for the upper limb is another matter. An artificial arm must be a real working tool. Only in the professional classes and for æsthetic reasons will an artificial arm which is passive and of no practical use be worn. In order that appliances suitable for all classes of the community may be at hand it will be necessary to have either a number of different models or else a model made in standardised interchangeable parts, by assembling which appropriately a limb can be made which is adapted to the needs of any trade or profession. The materials and mechanism should be such as to secure lightness with strength, and if it is possible without losing efficiency the shape should closely resemble that of the natural limb. It might be thought that the artificial arm was necessarily a passive appendage, hanging by its attachment to the stump but possessing no active mobility of its own. This, however, is not true; at least three movements can be transmitted from the chest and shoulder to the artificial limb, and these can be utilised to produce active flexion of the artificial elbow-joint, locking and unlocking of this joint, and opening and closure of the fingers of an artificial hand, or of a grip which replaces it. All these requirements and possibilities serve to indicate that the design of an artificial arm is a complex mechanical problem really requiring for its solution the consideration of a mechanical engineer of technical ability and experience. The necessities of war surgery have enlisted the assistance of engineers in this direction, and the address on "Mechanical Artificial Arms," delivered by Mr. E. W. HOBBS, A.I.N.A., at the Junior Institution of Engineers, on Oct. 15th, embodied the results of two years' experimental work. This work was originally undertaken at the instigation of Major ELMSLIE, and the results attained indicate both the complexity of the problem and the success that can be reached if mechanical ingenuity and experience work in coöperation with surgical advice. A simple arm can now be supplied which enables its bearer to do the hardest manual work, even to the swinging of a sledge hammer, while in a few minutes this same arm can be rendered sightly and mechanical movements added making it suitable for a professional man. Even when the whole limb is lost at the shoulder-joint an artificial limb can be fitted capable of voluntary movement at both shoulder and elbow, and of great use to a clerk or for other light occupation.

But the problem of artificial arms is not solved with the invention of a suitable appliance and its adjustment to the patient. There are complaints abroad, and well-founded ones, that men to whom artificial arms are supplied do not use them in their work. The reason for this state of affairs is threefold. In some few cases the arm is useless for the man's particular work, in others the arm is uncomfortable because it is unsuitable or is a bad fit, but most often the real reason is that the man has never learnt to use his arm, in his trade, to its best advantage. An artificial arm is a tool, its use must be learnt, just as is the case with any other tool. Some men will

realise this of their own accord and will set to work to learn the proper use of their limb, but others think that the artificial arm is going to replace the natural one without any effort of adaptation upon their part. Such men must be taught to use their limb by an actual training, first in the general use of the artificial arm, and then in its adaptation to their special trade. Until an artificial arm has been tested by such methods as these it should not be condemned as useless. It would seem that provision for training in the use of artificial arms, either in the hospitals which fit the limbs, or else in local schools or workshops, is required if much of the money which is being spent upon these appliances is not to be thrown away, and if the full work of the armless man is to be secured. A Bill is before Parliament for the representation on Local Pensions Committees of the disabled men themselves, and we trust that they will give careful attention to this need.

Annotations.

"Ne quid nimis."

THE INVESTIGATION OF ATMOSPHERIC POLLUTION.

WE publish this week in a special supplement the second report of the Committee for the Investigation of Atmospheric Pollution, the observations recorded being those made during the year 1915–16. The first report appeared in our columns of Feb. 26th, 1916, but since that date an important change has been made in the whole scheme of investigation. The work is now done under the ægis of the Meteorological Office and the original committee has been constituted an "Advisory Committee on Atmospheric Pollution" to that office. The undertaking thus receives official recognition and properly enjoys a status which association with an important Government department confers. The committee has received from the Department of Scientific and Industrial Research a grant in aid of the expert work involved in the investigations, and thus the pecuniary assistance needed to carry on the practical work should be assured. The present position is one on which the pioneers of the movement are heartily to be congratulated: it amounts to a well-deserved official recognition of work instituted and sustained by what was hitherto a purely voluntary body.

In the present report many interesting observations are made, though the reduction in the number of observers, that has taken place owing to the demands of the war has curtailed activities in some directions. But, as is appositely pointed out, the connexion between atmospheric pollution and fuel economy is of vital importance just now, for such inquiry brings to light the loss of combustible matter represented by the soot suspended in the air. The economic bearing, in other words, has assumed an increasingly serious aspect owing to the call for utilising the energy of coal on a more scientific basis. This question is receiving the attention of the Fuel Research Board which, amongst other things, is considering whether the 35 to 40 million tons of raw coal, which is used every year for domestic heating in this country, can be wholly or partially replaced by smokeless fuel, solid and gaseous, prepared by the carbonisation of this coal. The importance of such an inquiry was urged long ago by the Committee for the Investigation of Atmospheric Pollution, and practical investigations have abundantly shown what an appalling waste of fuel, with consequent pollution of the air and injury to health, our present methods of domestic heating involve. In last year's report it was shown that taking the case of the County of London alone the total quantity of matter deposited from the air during the year was approximately 54,200 tons, practically all derived from coal smoke. The present report shows, broadly, that far from an improvement having been effected, there has been at certain seasons of the year a heavier deposit in 1915–16 than in 1914–15. A detailed analysis of these cases is set out in the report and they afford an interesting study of the probable causes which underlie the variations in kind and amount of the deposit collected at different seasons. To quote examples showing the months of highest and lowest deposit for each element of pollution prepared from an average of 23 stations, we find that the items, loss on ignition and ash of the soluble matter, as well as sulphates, show the highest deposit in December, the second highest in January or February, and the lowest in March, April, or June, thus corresponding closely with the months of greatest and least rainfall. This clearly establishes a relationship between the deposit of soluble matter and rainfall. Tar and total solids have their greatest deposit in December and least in September and August. Generally speaking, maximum deposits occur in the winter months and minimum deposits in summer. It is suggested that a preponderance of insoluble ash in the summer may be accounted for, not by smoke pollution, but by dust, and the soluble matter is more affected by rainfall than the insoluble. There is a mass of valuable material in this report, and it represents careful work in many directions, but there are still some factors missing, and this fact precludes positive assertions being made as to the exact meaning of the results at the present stage of the inquiry. For example, the fact that measuring *deposited* impurity cannot provide complete information as to the degree of atmospheric pollution is admitted in the report. To some extent such estimation leaves out all consideration of more or less permanently *suspended* matter, and particularly gases, such as sulphur dioxide and ammonia. In dry weather these gases would not reach the gauge. The attention of the committee is being given to this matter. The statistics placed on record by the committee are, however, extremely instructive, and as further work is carried out the results obtained will bring nearer the possibility of making the conclusions definite.

THE COMING MINISTRY OF HEALTH.

Mr. Bonar Law, Chancellor of the Exchequer stated in the House of Commons last week that the creation of a Ministry of Health is under the consideration of the Government, but that at present no general solution of many obvious difficulties had been agreed upon. In these circumstances it is clearly wise not to introduce a Bill, but we cannot help feeling that a discussion in the House might tend to remove some of the causes of discord. Steps are being taken, the House was informed by Mr. Bonar Law, under which agreement will be ensured among those who are actively

engaged in the work of national health. We do not feel certain that those steps will have that result; the whole medical profession is included "among those who are actively engaged in the work of national health," and considerable divergence of opinion seems to mark their views as yet. For example, a large number of those most critical in days gone by of the working of the National Insurance Act are now prepared to regard that Act more favourably; they would give to the National Insurance Commission a predominant part in the future Ministry of Health. Dr. W. A. Brend, on the other hand, will have much support for the views which he puts forward in the current number of the *Edinburgh Review*. He premises in a short essay on the future of the Public Health Services that experience of the working of the Insurance Act has shown that measure to be seriously defective, and considers that it is an open secret that the National Insurance Act has not fulfilled in many directions what was hoped of it. The creation of a Ministry of Public Health is certain to take place, though the difficulties in the way of so important a piece of Parliamentary work are immense at the present moment. We trust that there will be no long delay, but we realise that to undertake so critical a piece of work, when due opportunity is wanting for full consideration of the accompanying difficulties, would not be promptitude on the part of any Government, but only mischievous yielding to the view of the muddler that something had better be done, whether for good or for evil. As we have pointed out several times in these columns, the position of National Insurance presents considerable difficulties to the designers of a Ministry of Public Health. The general view, and one which we have endorsed, is that the Local Government Board should become the over-authority for National Insurance, but Dr. Brend believes that the office of the Registrar-General should be enlarged and should take over the work of the Insurance Commissioners as well as the whole scientific and statistical work in public health at present performed not only by the Local Government Board but by the Home Office and the Board of Education. We admit that the Department of the Registrar-General could make a good claim if its scope were widened and its staff reinforced by experts, but we remain of opinion that if the National Insurance Commission does not remain a separate bureau, its right place is in a Ministry of Public Health, forming a department of the Local Government Board, and working in that department alongside of the machinery now employed to discharge the medical work of the Home Office and the Board of Education. There seems no doubt that we must not expect any concrete proposals from the Government for the creation of a Ministry of Public Health just yet, but this appears to us to be no reason why matters that require immediate reform should remain unattended to until a vague and future date. We are glad to learn that it is the intention of the President of the Local Government Board to ask the War Cabinet to allow him to introduce a Bill into the House of Commons immediately, so that it should be passed before Christmas, to deal with the many questions concerned with infant welfare. It is evident from his reply to recent deputations that he sees no need whatever to wait for the introduction of a measure to deal with certain existing evils until the Ministry of Health Bill, and he incidentally corrected a mistake made by Mr. Kingsley Wood in a letter recently published in the *Times*, who had used the argument for the establishment of a Ministry of Health that it would "save a thousand lives a week." Mr. Wood put that prediction into the mouth of Lord Rhondda. Lord Rhondda really said that he hoped that a Maternity and Infant Welfare Bill would save a thousand lives a week. Dr. Brend, in the *Edinburgh Review*, misrepresents Lord Rhondda in exactly the same way.

THE HARVEIAN ORATION.

Professor R. Saundby, in the Harveian Oration which we print in another column, considers Harvey's work in relation to the scientific knowledge and the university education of his time, especially university education in medicine. Harvey himself was a pensioner of Gonville and Caius College, Cambridge, where he entered in May, 1593, being then 16 years of age, and where he took his baccalaureate three years later. He then left Cambridge to study medicine at the University of Padua, where there was at the time a famous medical school; and while it is admitted that Harvey was the true discoverer of the circulation of the blood, it is fairly clear that our famous British philosopher did not owe so much to his English as to his Italian university, where many eminent philosophers were congregated at the beginning of the seventeenth century, and where he probably acquired the methods of research which led him to his great discovery. Professor Saundby's dissertation is largely about other people than Harvey, and forms an interesting chapter of medical history.

ACUTE NEPHRITIS WITHOUT ALBUMINURIA.

Dr. Carl Müller, of Christiania, has recently recorded[1] an interesting case of acute nephritis in which albuminuria was absent during the greater part of the attack.

The patient, a factory girl aged 26, was ill with "kidney disease" for two months in 1914. In 1916 she had a sore-throat and kept to her bed for a fortnight; the urine was free from albumin and no diphtheria bacilli were found on examination of a swab from the throat. After this she had headache and shortness of breath, with palpitations and a troublesome dry cough; a week later her face and hands swelled and she had pains in the back. Dr. Müller examined the urine and found no trace of albumin in it. The girl was living in miserable surroundings and was taken into hospital. Here she was found to have slight œdema of the legs, with a high blood pressure (185 mm. Hg), an irregular pulse of 60, slight hydrothorax and ascites, and a small trace of albumin in the urine when Heller's test was applied. No formed elements could be found in the centrifugalised urinary deposit. A few days later the percentage of urea in the blood was observed to be raised, standing at 0·025 per cent. The patient had severe headache, dyspnœa, and vomiting for the first 24 hours, with anorexia. On the fourth day she was put on to a salt-free diet of vegetables, bread, milk, tea, and water, and improved considerably. The œdema and fluid exudations were absorbed, the urine increased from nearly two to over four pints a day, and the blood pressure fell to the normal. The trace of albuminuria vanished after a week; at no time could cells or casts be discovered in its centrifugalised sediment. A Strauss test applied to the kidneys later showed that the renal excretion of both salt and water was normal.

Discussing this case, Dr. Müller comments on the extreme rarity of the instances of acute nephritis without albuminuria recorded in the pre-war medical literature. In trench nephritis, on the other hand, or in war nephritis as he prefers to call it, absence of albuminuria has often been recorded even in instances in which uræmic convulsions have occurred, and he points out that his recorded case in many ways resembles one of war nephritis. The

[1] Tidsskrift f. d. Norske Laegeforening, Christiania, 1917, xxxvii., 481

attempt has been made to explain some of these cases of œdema without other evidence of renal disease as due really to lack of vitamines in the food; the absence of nervous symptoms makes this explanation improbable. Again, it has been suggested that the lack of albuminuria in acute nephritis may be due to patchy involvement of the renal tissue with failure of the inflamed portions to secrete any urine; Dr. Müller thinks this explanation untenable, in view of the high blood pressure met with in such patients. He comes to the conclusion that acute nephritis without albuminuria is commoner in civil practice than is generally suspected.

THE VINDICATION OF A MEDICAL REPUTATION.

Dr. S. D. Clippingdale points out that Nov. 6th is the anniversary of what he describes as a "tragedy in the annals of English obstetrics," the delivery and death of H.R.H. the Princess Charlotte of Wales. The untoward event is thus announced in a *London Gazette Extraordinary* issued at the time:—

> "Her Royal Highness the Princess Charlotte of Wales was delivered of a stillborn male child at nine o'clock last night, and about half-past twelve Her Royal Highness was seized with great difficulty of breathing, restlessness, and exhaustion, which alarming symptoms increased till half past two o'clock this morning, when Her Royal Highness expired."

The Princess was in her twenty-first year. Her grandmother, Queen Charlotte, had been attended in her 13 confinements by a midwife, a Mrs. Draper, with the happiest results. When, however, the Princess Charlotte was known to be pregnant and an heir to the Throne anxiously desired, it was decided to take every possible precaution. Hers was the first Royal accouchement to be attended by male practitioners. Three were employed—Dr. Mathew Baillie, Dr. John Sims, and Sir Richard Croft. Of these, Sir Richard Croft was regarded as a specialist and controlled the case. Croft, although he appeared as a maternity specialist, apparently possessed no medical qualification. He was at Oxford for a short time, where Foster, in his "Alumni Oxoniensis," describes him as "chirurgus privilegiatus," but mentions no degree. He was not a Member of the Royal College of Physicians, was not upon the staff of any hospital, nor had he contributed anything to medical literature. He was, however, a man of high social position, and possibly his social position had something to do with his Court appointment. He inherited a baronetcy conferred upon his ancestor by Charles II. He married a twin daughter of Dr. Denman, the famous obstetrician (to whose practice he succeeded). Dr. Baillie, his colleague, married the other twin, so that there was a personal as well as a professional relationship between these gentlemen. The Court wished the Princess's confinement to take place at Kensington. The Princess, however, preferred Claremont, 15 miles away, and, at that time, not easily accessible. The labour was protracted and abnormal. There was hour-glass contraction of the uterus. The infant was known to be dead some hours before it was born, yet no steps were taken either to remove it or to terminate labour. The Princess was in an enfeebled condition from low diet, repeated bleedings, and unrelieved bowels. Finally there was post-partum hæmorrhage. A Mr. Jesse Foot demanded a public inquiry, stating, upon the report of the nurse, that when the infant was born, all three doctors were fast asleep. This, however, was denied by Dr. Sims, who, in a letter which will be found in Playfair's "Midwifery," says: "It has been said we had all gone to bed, but this is not a fact. Baillie retired about 11 and I lay down in my clothes at 12, but Croft never left her room." A path is still shown at Claremont where Sir Richard Croft had walked up and down in agony not knowing what to do for the best, and Foot's statement that he went to bed is a libel. By command of the king a post-mortem examination was made by Sir Everard Home and Sir David Dundas, who reported to the king that there was no evidence of neglect, but that everything had been done which "human science could devise or human skill effect." The event so preyed upon the mind of Sir Richard Croft that three months later he shot himself.

COLD AND COLDS.

THE bleaker days of early autumn have been accompanied with an abundant crop of colds, and the sequence is such a usual one that many people, perhaps the large majority, regard their catarrh as being directly caused by the reduction of temperature by what they call a chill. The belief lacks proof, inasmuch as precaution is generally taken to avoid the reduced temperature by means of artificial heat in houses and offices and the closing of windows in railway carriages. But this precaution introduces complicating factors. The indoor air becomes more stationary and humid; air-pockets are present in which little interchange occurs; there is a sharp dividing line between indoor air and outdoor air; and with these altered telluric conditions there is a tendency to crowd together and an increased nearness of contact in family life. In one respect, however, the conditions ahead should be changed in the coming winter. Fuel is dear and scarce, and it is both economical and patriotic to be sparing in its use. This will mean a reduction in indoor temperature, and less difference between indoors and outdoors. It will be worth noting whether the result is an increase or decrease of colds.

THE King has nominated Dr. J. C. McVail for a further period of five years a Member of the General Medical Council for Scotland.

NEWS has been received of the death, at the age of 60 years, of Sir C. Pardey Lukis, honorary surgeon to the King, who has held the position of Director General of the Indian Medical Service for a period of nearly eight years.

THE Bradshaw Lecture of the Royal College of Physicians of London will be delivered at the College by Professor Ernest S. Reynolds on Thursday, Nov. 8th, at 5 o'clock, the subject chosen being "The Causes of Disease."

THE Bradshaw Lecture of the Royal College of Surgeons of England will be delivered in the theatre of the College by Sir John Bland-Sutton on Thursday, Nov. 8th, at 5 P.M., the subject of the lecture being "Misplaced and Missing Organs."

THE opening meeting of the Röntgen Society will be held on Tuesday, Nov. 6th, at 8.15 P.M., at the Royal Society of Arts. The presidential address, on "The Part Played by X Rays in the War," will be delivered by Captain G. W. C. Kaye, M.A., D.Sc.

DEPARTMENTAL COMMITTEE ON THE WELFARE OF THE BLIND:

NOTES ON THE REPORT.

BY ARNOLD LAWSON, F.R.C.S. ENG.

AN immense amount of careful, patient, and thorough work is revealed in this report, which is a most complete and thorough exposition of a complicated national problem. A cursory glance through its seventy odd pages shows this much, whilst it may be stated that there is not a paragraph which will not repay careful reading and thoughtful consideration. The various issues raised in the discussion of this large subject have each of them received ample attention by the division of the Report into 12 sections or heads followed by a general summary and conclusions.

Definition.—Statistics and Causation.

These sections commence with the Report of the Royal Commission of 1889, followed next (Section II.) by a most interesting outline of the scope of the problem. This includes statistics and data with regard to the number and occupations of the blind and particulars of the present position as indicated by reports furnished by the various institutions devoted to helping the blind and by the Poor-law returns. The section commences by defining blindness for the purpose of the Report. In the case of children the definition adopted by the Elementary Education (Blind and Deaf Children) Act, that in this Act the expression "blind" means too blind to be able to read the ordinary school-books used by children, is considered satisfactory. The definition of blindness in adults has always been a difficult matter, as obviously it is a term that can be applied with fairness to a large number of those who still have a little sight, though insufficient to enable them to lead independent lives. The Report decided to adopt the definition of blindness as expressed by the subcommittee of the Ophthalmic Section of the Royal Society of Medicine and adopted by the council of the section (1915), which suggested that "blind means too blind to perform work for which eyesight is essential." It is not likely that any will be disposed to question this definition as being fair, practical, and covering all debatable ground.

The Report then goes on to deal with statistics as to blindness and the causes of blindness. It points out that with regard to the number of the blind in this country the want of an exact definition as to the meaning of the term has made statistics very unreliable. So far as can be gathered, there seems of late years to have been very little change for the better. Ophthalmia neonatorum still claims its 10 per cent., but the returns only take us down to 1914, when notification first became compulsory. It was suggested by an eminent authority in his evidence on this point that the disease had been practically stamped out in lying-in hospitals, but possibly this rosy view will not bear very close investigation. It is hard to believe that even the greatest care, and the adoption of every precaution, will suffice to stamp out this disease, which will annually claim a percentage of victims even at lying-in hospitals. It is to be hoped when returns are available that notification will have proved to have been of some benefit, but the value of notification must necessarily depend upon its reaction with regard to the practical treatment of the disease, and of that we have so far no record.

Attention is called to the Report of the Royal Commission on Venereal Diseases, which came to the conclusion that over 50 per cent. of all cases of blindness was due to venereal diseases. That is undoubtedly a statement which every expert in this country will endorse. It is a very serious state of things and will continue to be so in spite of all the new and successful treatment of syphilis until the country has made up its mind to treat the question of syphilis itself in some saner and more practical manner than seems at present likely.

Occupational blindness—i.e., resulting from injuries received in the course of various trades—should, the Report says, receive more energetic treatment of a preventive nature. As a matter of proved fact, no force on earth short of compulsion by Act of Parliament will make the British workman adopt an attitude of common-sense in this matter and wear protecting goggles at his work. The Report rightly suggests obligation, but does not mention who is to enforce it.

The greater part of the remainder of the Report, until we reach the general conclusions and summary, is devoted to the practical solution of the questions appertaining to the welfare of the blind, and deals therefore with education in its various aspects of elementary, professional and industrial, workshops, and miscellaneous organisations. It will be best to follow the Report over these various points by the consideration of the conclusions which follow them. These form 12 most admirable pages containing a great deal of original thought, and though some of the conclusions are controversial and unlikely to be adopted as they stand, still they tend to flood the problem of the welfare of the blind with new light, and this undoubtedly will lead to great things in the near future.

Central Control.

It is noteworthy that the first three paragraphs of these conclusions tread on altogether new ground. Placed before the consideration of any one question of education or training, and obviously put in this position in order to make them assume a capital importance, the committee recommend and have drawn up in these paragraphs a scheme of central control. Let us see what this means in the words of the Report:—

"We have come clearly to the conclusion that the condition of the blind in the United Kingdom calls for the more active intervention of the State to secure (*a*) central control, organisation, and assistance for the existing agencies of voluntary help, which could be utilised with far greater effect if centrally directed, and (*b*) additional assistance for the blind."

Following this preamble comes the outline of the scheme. Shortly it proposes the setting up of a special department known as the "Central Authority in the Ministry of Health," when and if such a Ministry be created, and in the meantime in the Local Government Board, its function to be the general care and supervision of the blind. The work would necessarily involve a large financial outlay, partly to meet the expenses involved in starting the recommendations which the committee favour later on (initial capital expenditure) and partly to provide for upkeep (annual expenditure). Much of the money required would probably be, as regards the former item, met by special grants from the votes of the Education Department. The committee are of opinion that the most urgent and expensive essential in this respect is the provision of more workshop accommodation. It calculates that about 3000 such shops at a cost of £100–£175 each are needed, involving an outside expenditure of about £500,000. The annual expenditure, it is explained, is extremely difficult to estimate. It would be concerned in respect of grants to institutions and organisations for the blind, pensions, and any other purposes which might arise from time to time. It is considered that it would probably be covered by £250,000 per annum. Passing on to the constitution of this proposed central authority the committee are of opinion that it should be carried out under the guidance of a strong advisory committee of persons associated with the care of the blind, the chairman of the advisory committee to be the Parliamentary secretary of the office in which the new department is established. All matters of policy should be referred to this committee, whilst all executive functions should be exercised by the department working in accordance with the recommendations of the advisory committee.

Such, briefly, is the scheme—a really big scheme, and undoubtedly the right one, and far ahead of anything that has hitherto been projected. There can be no possible doubt that if the question of the welfare of the blind is to be seriously tackled with a view to permanent and progressive improvement coördination of effort is essential. Coördination of effort can only be obtained by centralisation of effort, and centralisation further means economy of effort. It is the only means of stopping or limiting overlapping of work and extravagance in finance. The desirability of a central authority or board is therefore beyond question. The practical application of the scheme is obviously controversial, as, for instance, the recommendations as to finance, which are pious suggestions based on the theory that the wider you open your mouth the more you will get. However that may be, there is little doubt that if the principle of a central authority is adopted the money will be forthcoming from

somewhere. The intrusion of a Government official as the nominal head of such a board may be inevitable though it seems unfortunate. It is not to be expected that he would have any special knowledge, and certainly the interference of the State in the management would not conduce, if past history is to be trusted, to the success of the scheme. The ideal condition would be State-aided but not State-controlled.

Certain reservations have been appended to the scheme by some of the members of the committee. One of these, dealing with the financial aspect, favours a system of State pensions, for which there is something to be said, but there are many obvious difficulties. Even supposing that the greatest supervision is exercised, so that pensions are only granted to those properly qualified, there still can be no guarantee that the money is laid out in a suitable way by the recipient; and, further, it is certain that once the pension had been granted it would be exceedingly difficult to take it away, or, in fact, to control it at all, supposing the pensioner should prove himself in the future unworthy of help. In another reservation objection is made to the Exchequer being regarded as solely responsible for the necessary funds, and a point is made that there are other classes, such as deaf-mutes and the paralysed, for whom State aid could be demanded with equal force as for the blind. There seems at the present juncture to be no special reason to open a controversy as to ways and means. The main point is to establish a working basis, and something on the lines suggested by the Report which all the members have signed will be found to be the right guiding principle for action in the future.[1]

Education and Training.

The Report favours residential institutions rather than day centres for elementary education of young children, together with the employment of blind teachers whose salaries should be on an equality with those of sighted teachers.

These are two most important points. With regard to the first, the reservation made by three members that education in residential institutions is not desirable for the majority of *young* blind children has much force. Institutional life, as pointed out in this reservation, is a poor substitute for home and family life, and it is difficult to understand why a young blind child should be sent to a boarding-school at an earlier age than a sighted child. It would, indeed, have been better if the Report had substituted "older" for "young," or specified some age such as "after ten years of age." The value of blind teachers is a proved fact, and in the future it is hoped that the practice of teaching the blind by the blind will become as universal as it is practicable. The note as to the salary paid to the blind teachers is inspired by obvious fairness.

Perhaps the most striking recommendation with regard to elementary education is the initiation of an after-care scheme to enable the authorities to keep in touch with each child after leaving the elementary school until he or she can be transferred to the care of either the secondary education authority or to some recognised organisation for the blind. This is excellent.

Professional and Industrial Training: Workshops and Miscellaneous Organisations.

Passing on to the training of adults in all its various phases, the Report is extremely practical, and this part can be recommended to the careful perusal of all those interested in the subject. The following are of special importance.

(*a*) The committee is satisfied that the crux of the problem of the blind in the United Kingdom is the inadequacy of workshop accommodation. The evidence is conclusive that the present accommodation should be doubled, and even this may not be sufficient.

(*b*) In addition, inspection and standardisation of production must follow with a system of coöperative buying of raw material and selling of produce.

(*c*) Persons who work at home should be visited and assisted in the purchase of materials and the marketing of their goods.

(*d*) Particular attention is called to the employment of blind women, who, except in rare cases, are unable to earn anything approaching an adequate wage.

(*e*) There is an urgent need for a central free library for the blind which, acting in coöperation with the home teaching societies and public libraries, would facilitate the circulation and distribution of books available, and minimise the danger of unnecessary duplication in production.

Each one of the above recommendations is both novel and excellent. They all help to show the urgency of a central control authority, without which not one of them is practicable. It is devoutly to be hoped that the institution of such a central driving force will not be shelved, and indeed it is not likely that such will be the case, seeing how the war has aroused the general interest of the nation in those who have suffered from it.

The Report finishes its work with some recommendations with regard to the administration of the Poor law and pensions and a well-deserved note of confidence and approbation of the steps taken at St. Dunstan's Hostel to ensure the welfare of our blinded soldiers and sailors. Many of the recommendations of the committee with regard to the training of the blind are at the present time in force at St. Dunstan's and are answering well.

Place of Ophthalmology in Medical Education.

Further, before closing I wish to note a reservation signed by Sir Arthur Downes, who once more desires to draw attention to the memorial to the General Medical Council from the Ophthalmological Society of the United Kingdom in 1891, which points out the desirability of a more general knowledge of ophthalmology by the general medical student, it being "notorious that the general body of the profession does not possess a competent knowledge of diseases of the eye."

That opinion, unfortunately, holds as good to-day as in 1891. When will the universities and colleges realise the necessity for a forward move in this respect? This war has shown us many things, and none more clearly than this—viz., the general lack of knowledge of the treatment of eye diseases and injuries. Many eminent experts in this branch of surgery are doing their utmost at this moment, and doing it well, but it is only the bare truth that a certain number of blinded men drift from hospital whose sight might at least have been partially saved if their cases had been understood, or at any rate treated on proper lines. The whole fault lies with the examining boards, the members of whom are admittedly entirely at sea in everything that appertains to ophthalmology, and who, therefore, can hardly be expected to examine students on this subject. The students know this, and, having quite enough to do to deal with the subjects of which the examiners are cognisant, they, or the greater number of them, simply neglect ophthalmology.

NATIONAL INSURANCE ACT.

Treatment of the Invalided Sailor or Soldier.

MEMORANDUM 234/I.C., setting out a scheme for the treatment of sailors and soldiers discharged as no longer physically fit for war service, was briefly summarised in THE LANCET of Sept. 8th, p. 404. The Memorandum was marked by the Insurance Commissioners who compiled it as being "For Issue to Doctors," and since its appearance it has received careful attention at the hands of those members and sections of the medical profession likely to be most affected by it. Its reception has not been favourable. The medical practitioners who serve on the panels and who, for the most part, have done so ever since the first National Insurance Act came into force, are not only interested in the matter to a greater extent than their non-panel colleagues, but having been constantly in touch with the practical aspects of the Insurance Acts are, to speak generally, in the position of expert critics.

The criticisms levelled at the Commissioners' scheme are, in the first place, directed against the principle and details of the financial arrangements proposed, the main contention being, to quote from a resolution of the Gloucestershire Panel Committee, that "while the machinery of the Insurance Act may conveniently be employed, the expense should be met by a Treasury grant, and should in no way fall upon Insurance funds." To what extent the proposals of the Commissioners involve drawing upon Insurance funds for the provision of medical benefit for uninsured sailors

[1] On Wednesday last, since this article was written, the Prime Minister has stated that the recommendations of the Departmental Committee will be favourably considered by the War Cabinet.

and soldiers is not quite clear. Correspondence which has passed between the Gloucestershire Local Medical and Panel Committee and the Commissioners shows that in the opinion of the latter the former body had misconstrued the intention of the Commissioners, and had not understood the source from which credits in respect of discharged sailors and soldiers are to be added to the central pool. The correspondence, however, does not state definitely that no money contributed by insured persons for the purpose of providing medical benefit under the Insurance Acts will be diverted towards medical benefit for uninsured sailors and soldiers. And whether the discharged sailor or soldier has been insured or not the obtaining for him medical benefit in respect of injury or disease due to military service was not, it may reasonably be said, contemplated when the Act was passed, and was not provided for in it. Objection is further taken by many to the institution of a system of payment per attendance in the place of a capitation system to be based upon a reasonable estimate of the services to be rendered.

A second criticism of the payments per attendance proposed is that they are inadequate, and must take into account present and probable future conditions of high prices. A further point at issue is the inclusion of non-panel practitioners in the scheme in order that they may attend discharged sailors and soldiers only. In any case they would benefit by the machinery of an insurance system with which they have refused before to have anything to do, and if any part of the moneys paid to them were derived from Insurance funds, it is contended, they would be receiving money contributed by insured persons and their employers and diverted from the remuneration of practitioners on the panel. Memorandum 234/I C., in dealing with the projected inclusion of non-panel practitioners, states that it is being brought about "at the request of the medical profession," but the panel committees complain that they have never been consulted at all before the new system was instituted. This being the case, the practitioners who have worked, and are working, the Insurance Acts, have not had any voice as a body in an expression of opinion ascribed to the "medical profession." It is a point which intimately concerns them, and upon which, and upon the introduction of payment per attendance, they can justly claim that they were entitled to be heard. It is to be regretted that such a matter as the medical attendance of those who have suffered so much for their country should give rise to any controversy, but at the same time it is better that an understanding on the subject should be arrived at, so far as it is possible, at the outset. It is highly undesirable that a new system should be initiated without the best possible prospect of smooth working.

Insurance Practice in Scottish Rural Areas.

A report on medical benefit in Scotland has been prepared, at the request of the Scottish Association of Insurance Committees, by Mr. W. M. Marshall, its secretary, and issued as a pamphlet of 48 pages (Motherwell, K. Cameron and Co.) A section of this report is devoted to the country doctor in Scotland and his difficulties.

We may reproduce some passages from the letter of a rural practitioner:—

"So long as the medical man is paid per capita the rural practitioner is very seriously handicapped. In a town or village practice eight or ten visits at patients' homes can be overtaken in an hour. In the country a whole hour may be consumed in visiting a single case. The question of roads has to be considered. Isolated cottages at considerable distances from the main roads are common, and it is often necessary to leave one's trap or car in the main road, even in the summer time, and accomplish the object on foot. In winter, often for weeks at a time, the main roads are impassable through snow-drifts, and to reach a patient many miles have to be covered on foot. ..... The dangers to be faced, the difficulties to be overcome, and the time lost have all to be considered in estimating the special disadvantages of rural practice. Add to that the meagre and often uncertain financial return, and you will get some idea of the lot of the country doctor."

It is generally assumed, the report comments, that the remuneration of the country doctor for each member on his list is higher than that received by his town colleague in respect that he has fewer services to render and is more rarely called upon for treatment, but it is now certain that the visits by the country doctor are not less in proportion to his list than those made by the town or industrial doctor. An examination is appended of the medical records furnished by 15 practitioners in Lanarkshire, three of whom were in practice in rural, two in mixed rural and industrial, and ten in industrial areas. In the rural doctors' list 69 per cent. were male insured persons and 31 per cent. female, as against 79 per cent. male and 21 per cent. female in the industrial areas. In regard to actual services rendered by the country doctor as compared with his industrial colleague, in the case of the first it stands at 4·07 (visits and consultations combined) for each person on his list, as compared with 4·37 for each person on the list of the industrial doctor. But the average visits paid work out at 2·85 for every person on the list of the country doctor, and only 1·71 in the case of the industrial doctor. The report admits that the evidence gleaned from these few practices is insufficient to justify definite conclusions, but the figures as a whole confirm the view that in justice to the country doctor some readjustment of the terms of service is necessary. The figures for Lanarkshire are, indeed, much more favourable to the position of the industrial doctor than the figures for Scotland as a whole. If special consideration is not given to these matters there may be increasing difficulty in securing the services of capable and energetic men for the country districts.

Obituary.

JOHN GORDON SHARP, M.D. EDIN.

Dr J. G. Sharp died suddenly from cerebral hæmorrhage on Oct. 16th, at his residence, 9, Cavendish-road, Leeds, aged 55 years.

John Gordon Sharp received his medical education at Edinburgh University, where he obtained the Milner Fothergill Gold Medal in Therapeutics; at Owens College, Manchester, where he was research student in pharmacology, and at Paris and Berlin. In 1891 he graduated M.B., C.M., at the University of Edinburgh, and five years later took the M.D. degree, for which he was commended. About this time—namely, some 22 years ago—he bought a practice in the Woodhouse and Meanwood Districts, Leeds, and took an active interest in the medical needs of the community in which he had settled. He was honorary surgeon to Beckett Home for Waifs and Strays, and prominently associated himself in the establishment of the Southern Dispensary in Hunslet-road, which was afterwards amalgamated with the Public Dispensary in North-street. He was one of its first medical officers, and continued to work up to the time the branch was closed owing to the difficulty of getting residents during the war. Dr. Sharp, who was a prominent pharmacologist, was a member and foreign corresponding secretary for the Section of Therapeutics and Pharmacology of the Royal Society of Medicine, and gained in 1910 the Hunterian Medal for an essay on ergot. In October, 1915, he joined the R.A.M.C. as a temporary lieutenant, and did 12 months' service in this country. Relinquishing his commission, he still continued to do war work at Chapeltown-road Barracks and elsewhere until his death. He was a frequent contributor to the *Journal of Anatomy and Physiology*, to the *Transactions of the Therapeutical Society*, to the *Pharmaceutical Journal*, the *British Medical Journal*, and THE LANCET, his contributions to our own columns including an interesting paper on Intralaryngeal Therapeutics. Dr. Sharp leaves a widow and two daughters.

DR. J. RAMBOUSEK,

PROFESSOR OF FACTORY HYGIENE, AND CHIEF STATE HEALTH OFFICER, PRAGUE.

WE regret to announce the death, at the age of 43, of Dr. Rambousek. He was recognised as one of the leading writers and workers on factory hygiene on the Continent, and it was noteworthy how ably he seemed to combine the duties of professor, inspector, and laboratory worker. His industry in collecting material for anything about which he wrote was remarkable. He was best known by his book "Gewerbliche Vergiftungen," which was translated into English and published by Edward Arnold in 1913 under the title of "Industrial Poisoning: From Fumes, Gases, and Poisons of Manufacturing Processes." In 1911 he made a short visit to England, which he much enjoyed, leaving behind him the impression of a delightful personality.

Correspondence.

"Audi alteram partem."

SUCCESS AND FAILURE IN THE TREATMENT OF TUBERCULOSIS.

To the Editor of THE LANCET.

SIR,—In your leading article of Oct. 20th on the above subject a curious mistake occurs in the citation of the Edinburgh Dispensary Scheme as if it represented a special method of *treatment*. Coupling it with two other therapeutic procedures, the writer of the article goes on to say that "the hopes raised by these have died down." The reference is apparently to what has been called the Tuberculin Dispensary, with its restricted therapeutic outlook, and not to the Edinburgh Tuberculosis Scheme, for later on the article proceeds:—

The work of the Tuberculosis Dispensaries of our great cities and such an organised system of control as that under the direction of the Chair of Tuberculosis at Edinburgh are on the right lines.

The purposes and scope of the Edinburgh Scheme are too familiar to call for detailed re-statement now. The erection of the Edinburgh Tuberculosis Dispensary in 1887 was a systematised attempt to utilise the discovery of the tubercle bacillus in the interest of public health. Its purpose was to create a central institution which would deal with the varying aspects of tuberculosis. The lines of its operations, its gradual development as the centre of a communal organisation against tuberculosis, and its several extensions in the sanatorium, the hospital, the tuberculosis school, the farm colony, the care committee, &c., are well known. They have been detailed in successive papers since the foundation of the dispensary onwards. The principles and methods were endorsed by the Local Government Board for Scotland,[1] and subsequently by the Departmental Committee on Tuberculosis.[2]

If, as you say, "a vast social organisation to deal with tuberculosis has been set in movement," is it wise or just to say that "gloom has fallen on the treatment of tuberculosis"? True, for the moment, the large movement—like so many other social activities—is held up through the war. Before the crash came, Local Authorities, Insurance Committees, &c., throughout the country were beginning to collect and put together the component elements of a satisfactory machinery. In some places the machine was almost ready; in others, parts were missing; in few places—if in any—was it quite complete. When war was declared, things were immediately stopped, and tuberculosis officers, who had been appointed to drive the machine, were called away by the exigencies of the moment for service with the troops. The Local Government Boards have done something to keep men at the tuberculosis posts, but the major necessity has known no law. The fact must not be lost sight of, however, that the foundations of an efficient anti-tuberculosis scheme have been laid. A good deal of the superstructure exists, and, in numerous centres, work is being overtaken. The 12 per cent. increase in mortality from tuberculosis for 1915–16 does not seem to have occurred uniformly throughout the kingdom, and a good deal might be said in explanation of the increase.

Of remarkable significance in judging of the value of anti-tuberculosis effort is the striking difference between the incidence of tuberculosis among the British troops and its incidence among the French troops. Where we calculate in thousands, our gallant Allies have unhappily to reckon in tens of thousands. At the present moment the medical service in France is at its wits' end to adapt measures equal to the clamant needs with which they have to cope through the ravages of tuberculosis. In attempting to determine why this extraordinary difference in the effects of war should present itself in the case of two neighbouring countries with similar civilisation, it would be foolish to lose sight of the remarkable difference which existed prior to the war in respect of the coördination of antituberculosis measures. An unprejudiced expert observer, Dr. Hermann Biggs, puts the matter in a nutshell. "In England," he says, "the tuberculosis problem had been efficiently met before the war; in France, on the other hand, practically nothing had been done."

I am, Sir, yours faithfully,

Edinburgh, Oct. 20th, 1917. R. W. PHILIP.

[1] Vide Circular on "The Administrative Control of Pulmonary Phthisis," March 10th, 1906.

[2] Vide Interim Report, 1912, and Final Report, 1913.

To the Editor of THE LANCET.

SIR,—I have read most carefully the leading article in your issue of Oct. 20th, entitled "Success and Failure in the Treatment of Tuberculosis." The subject is of such importance that it is highly desirable that we should be clear as to what we want to do and how we want to do it. Your leading article, however, seems to me to leave the subject in a very confused condition. You say:—

The keen hopes raised by the open-air methods introduced from Nordrach, by the Edinburgh Dispensary Scheme, by the Frimley graduated exercises, have died down.

And further on in the same paragraph:—

In spite of the vast amount of trouble and administrative machinery we have not kept pace with the disease.

Am I not right in concluding that you think all these methods are failures? And yet towards the end of the article you say:

The mechanism of tuberculosis control is good and only requires to be properly applied. The work of the tuberculosis dispensaries of our great cities and such an organised system of control as that under the direction of the Chair of Tuberculosis at Edinburgh are on the right lines.

How can we reconcile these varying statements? Has not the Edinburgh scheme been under the personal control of the new professor since its inception? How can it be on the right lines and yet be a failure? Surely this and the other methods must be on the wrong lines.

You seem to think the failure is due to the patient not applying for treatment until the disease is fully established. My experience is that most cases do seek advice early, and are given cough bottles, being assured that they have not got tuberculosis if tubercle bacilli are not found in their sputum. You blame the patient for refusing to go to a sanatorium when it has just been stated that the sanatorium method is a failure. You state that the practitioner cannot devote enough time to make an early diagnosis. What methods do you want the doctor to use? Physical signs such as light percussion or auscultatory signs? Do you think these are reliable methods in the stage it is desirable to make the diagnosis? Are X rays available and always reliable in this earliest stage? If not, what method is the practitioner to rely on? The only reliable method—viz., the subcutaneous inoculation of a sound tubercle antigen—is only exceptionally employed.

I quite agree with you when you say that

No serious progress can be made without close co-operation between these three essential links in the chain of administrative control—the patient, his doctor, and the tuberculosis officer.

But I cannot understand the line of thought in the succeeding sentence—

In certain places where the coöperation has been complete the success of dispensary treatment has been such that undue emphasis has been laid on such minor adjuvants as the administration of certain remedies.

If the treatment has been successful where these remedies are used, and unsuccessful or less successful where they have not been used, what is one to conclude? Surely that the remedies are what has made all the difference. In the last sentence you hope for complete success in the stamping out of the disease on return to normal conditions after the war, the greater coöperation with the general practitioner, and the more complete training of the tuberculosis officer. Training in what methods? In the methods that have produced such a complete failure?

Let me turn now to your attitude towards those who, having realised that the at present practised methods of prophylaxis are futile, wish to try other methods. You say:—

The contrast is so vivid between apparent administrative failure in regard to tuberculosis and the dramatic success achieved in stamping out enteric fever by means of prophylactic measures that increasing pressure is being brought to

bear on authorities to treat tuberculosis as a contagious disease and the sufferer from tuberculosis as a social pariah to be isolated from his fellows.

I would ask if the enteric as have been stamped out by isolation of victims of the disease or by preventing their development by prophylactic inoculation? And why is this prophylactic inoculation done in armies and in individuals who are going to countries where the disease is rife? Surely because they are nearly certain to get infected, just as we all know, and you point out, the person who does not get infected with tuberculosis in these countries is the exception. Why, then, object to trying methods in tuberculosis which have been so very successful in typhoid? Surely there is a reasonable hope of success.

I am, Sir, yours faithfully,

W. M. CROFTON.

Laboratory of Special Pathology, University College, Dublin, Oct. 22nd, 1917.

*** Sir Arthur Newsholme's report shows that the war has given tuberculosis a good start while handicapping our measures for dealing with it. This looks like failure, and many people, Dr. Crofton among them, have taken it as such. Sir Robert Philip blames us for giving publicity to this wide sense of discouragement because, as he says, the foundations of an efficient anti-tuberculosis scheme have been well and truly laid. But it was precisely the object of our article to point this out in the face of the evidence to the contrary. Our critics do not make any points against us that lead us to alter a single expressed view, though they differ from each other considerably.—ED. L.

WAR DEAFNESSES.

To the Editor of THE LANCET.

SIR,—With regard to the article on hysterical deafness in soldiers in THE LANCET of Oct. 6th, your leading article (Oct. 13th), and the letter by Major A. F Hurst and Captain E. A. Peters (Oct. 20th) may I be permitted the following remarks. The first case recorded by the above named authors was so obviously hysterical that it requires no further notice. The second case, while not so obvious, certainly on the face of it suggests either hysteria or malingering, because complete deafness occurred under circumstances with which we are not accustomed to associate this phenomenon. It would not, therefore, appear that either of the cases presented much difficulty. The observation, however, that in both loud noises failed to waken the patients is interesting.

When the authors say "we have found it necessary to discard almost all the criteria formerly used in the diagnosis of organic deafness from deafness due to hysteria or malingering" we are entitled to expect something very original, if not epoch-making. They must be aware that cases of true hysterical deafness are so rare that a careful record of 200 cases would be expected to give data which might well come under the latter classification. Let us hope that they will not long delay the production of their records.

With regard to their views as to the importance of vestibular reactions in diagnosis the following objections occur to me: 1. Vestibular reactions are present, if perhaps somewhat delayed, in cases of "noise deafness" (sometimes called boilermakers' deafness). 2. In cases of concussion deafness due to artillery vestibular reactions are retained. It is inconceivable that the authors desire to deny the occurrence of almost complete organic deafness from such causes. This brings me to another point. They state that in the deafness resulting from cerebro spinal meningitis if there be complete deafness part of it is hysterical. The actual fact is that sufficient organic deafness is frequently left to make the sufferer, if a child, a deaf-mute. The question, then, of a little more or a little less must be of more academic than practical interest. Finally, on what grounds do Major Hurst and Captain Peters make the following statement, "But it must be remembered that in partial organic deafness the vestibular reactions are lost in the severer cases and exaggerated in the slighter cases"? My own view is that hysterical deafness may be suspected in cases in which the history indicates a chain of circumstances which the experienced observer is not inclined to consider sufficient to account for the great amount of deafness. For the rest these cases conform to the type we are accustomed to meet with in lesions of the sound-perceiving apparatus. In general the diagnosis can only be made with certainty after recovery, which is sudden. Unless further proof is forthcoming, I shall be disinclined to attach supreme importance to the presence of vestibular reactions as an aid to diagnosis of hysterical deafness.

I am, Sir, yours faithfully,

Edinburgh, Oct. 21st, 1917. P. MCBRIDE.

DIATHERMY.

To the Editor of THE LANCET.

SIR,—I was much interested in reading in THE LANCET of Oct. 20th Dr. L. W. Bathurst's account of the successes he has recently obtained from the use of indirect diathermic fulguration, a method which I originally described in a paper I read before the Electro-Therapeutic Section of the Royal Society of Medicine on Feb. 18 h, 1916 and which appeared in the Proceedings of that Society, March, 1916, and also in the *Journal de Radiologie et d'Électrologie*, July, 1916.

Since I last explained the details of the method to Dr. Bathurst I have considerably modified its technique. I find that by far the best fulgurating instrument for general use is a Primus Pricker, an instrument sold at any ironmongers in 3*d*. packets for cleaning the nipples of the well-known Primus petroleum stoves. In some cases, such as when treating the hands, or when treating children, or when operating under an anæsthetic, I bandage a 20 × 10 cm. electrode on the thigh, arm, or abdomen of the patient instead of using the hand electrodes. It is not essential to use the somewhat expensive and cumbersome autocondensation couch. A very simple and efficient substitute can be cheaply made by taking a three-ply board the size of the consulting-room couch or the size of the seat of a large chair, placing on this board a piece of zinc about 6 inches smaller in length and breadth, and fixing over this zinc a piece of vulcanite one-eighth of an inch thick and overlapping the zinc for 2 inches all round. The board is drilled and a terminal attached to the zinc. The insulating properties of the board are much increased by soaking it in melted paraffin wax. I have entirely abandoned the use of the ebonite rod, the use of which I formerly recommended to Dr. Bathurst, as I find that a small thin cushion, or even a folded blanket, is quite sufficient insulation and far more convenient to use. A rubber glove on the left hand forms, perhaps, the best support, and is very useful in eye cases for separating the lids.

Indirect diathermic fulguration has a much wider range of usefulness than the cosmetic purposes of which Dr. Bathurst writes. I have obtained very satisfactory and quick results in the fulguration of the nodules of lupus, in the treatment of rodent ulcer, chronic pharyngitis, epulis, epithelioma of the cheek, and many other conditions where the destruction of small superficial structures or growths is required. The accuracy of the application, and the ease and certainty with which its depth of action can be regulated, make it very useful in the treatment of certain conditions of the eye and eyelids. I have recently been treating by this means, apparently with success, an old-standing case of granular conjunctivitis, and also a growth, probably malignant, of the cornea. In the hands of a throat specialist this treatment would, I feel sure, be very useful for the destruction of laryngeal growths. This method of fulguration is in almost daily use at the Radcliffe Infirmary, Oxford, where its mode of application can be seen any morning by appointment.

I am, Sir, yours faithfully,

Oxford, Oct. 21st, 1917. W. J. TURRELL.

THE TREATMENT OF ENURESIS.

To the Editor of THE LANCET.

SIR,—Enuresis is a diagnosis which includes so many causative conditions that I think it would be advisable if Mr. A. R. Thompson, whose letter on this subject appeared in your issue of Oct. 20th, would describe the class of case for which treatment by gradual dilatation of the bladder is suitable. I am somewhat surprised that he and his acquaintances are not familiar with this method. In my book on "The Diseases of Children," 1910 (p. 566), I refer to it as appropriate for intractable cases after puberty, as in girls constant enuresis may lead to the bladder becoming unduly small. Possibly it may be a justifiable measure at an earlier age, in spite of the objections appertaining thereto. And it must be remembered that many and various methods prove curative, probably through the psychical effect. Mere change of surroundings, such as admission to a hospital

ward, is sometimes sufficient to break the habit. The method is also mentioned by Dr. Leonard Guthrie in discussing functional diseases of the nervous system[1] as suitable for inveterate cases of irritable contracted bladder. Admitting that the treatment may be advantageous in some cases, I think it should be clearly stated that it is not necessary or advisable for the majority, and that it must not be employed indiscriminately. It is only appropriate for certain cases which ought to be defined.

I am, Sir, yours faithfully,

Park-street, W., Oct. 22nd, 1917. EDMUND CAUTLEY.

To the Editor of THE LANCET.

SIR,—The treatment of enuresis by gradual dilatation of the bladder is not new. I carried out the treatment in a very bad case in a girl 14 years of age, acting upon the advice of Mr. (now Lieutenant-Colonel) E. Tenison Collins, in 1903. Four ounces was all the girl could take at first; this was gradually increased to 12 ounces, and at the end of a fortnight treatment was stopped. There has been no relapse. I am, Sir, yours faithfully,

Penarth, Oct. 20th, 1917. G. P. JAMES.

INSANE SAILORS AND SOLDIERS.

To the Editor of THE LANCET.

SIR,—Dr. J. F. Gemmel in his letter in your issue of Oct. 20th objects to "Service patients" on two grounds. First, because they are "certified"; and secondly, that, being in a public asylum, they have the "taint and stigma" of pauperism. My experience of the social class from which the majority of sailors and soldiers come is that they do not object to certification (a procedure they know little about) so much as to being sent to an asylum. The large military asylums which are suggested would suffer from the same "stigma" as the county asylum. Secondly, there are many private patients in public asylums, and they do not suffer from the stigma of pauperism. The "Service" patients are private patients.

Dr. Gemmel has, however, put his finger on the weak point of his own plan. One of the greatest pleasures the insane have is to receive visits from their relatives, and to deprive them of the possibility of such a privilege would be downright cruelty. It is all very well to write of hardships as being unavoidable in war, but surely the whole aim of Dr. Gemmel's letter is to remove hardships, and so far as I can see it merely replaces imaginary ones by a very real one. To my mind the Ministry of Pensions and the Board of Control have grappled with a difficult problem in a most satisfactory manner. I am, Sir, yours faithfully,

City of London Mental Hospital, near Dartford, Kent, Oct. 20th, 1917. R. H. STEEN.

THE CONTINUOUS ADMINISTRATION OF ASPIRIN.

To the Editor of THE LANCET.

SIR,—The following case will perhaps help your correspondent, "J. O. H.":—

A. H., a lady, aged 30, recently consulted me on account of curious sensations in her head, the chief of which was that when she entered a room she always saw a large box over which she had to step before being able to get to the other side. The history was that she had suffered from headache for a long time, for the relief of which she had taken aspirin freely. She was in a very nervous state, very active, and anxious to do her duty. Thorough examination failed to disclose any actual disease, but the ophthalmoscope revealed error of refraction. I sent the patient to an ophthalmic surgeon, who reported the presence of hypermetropic astigmatism, and prescribed glasses. She was ordered to discontinue the use of the drug. From that time the patient lost all her headache and other symptoms.

I have no doubt that the reckless way in which aspirin is frequently prescribed would account for some obscure nervous conditions. Sisters and nurses in nursing homes are much given to doping patients with aspirin entirely on their own account, a practice which cannot be too strongly deprecated.

I am, Sir, yours faithfully,

Harley-street, W., Oct. 17th, 1917. CHARLES W. CHAPMAN.

[1] Diseases of Children. Edited by Dr. A. E. Garrod, Dr. F. E. Batten, and Dr. J. H. Thursfield, 1913.

The War.

THE CASUALTY LIST.

THE following names of medical officers appear among the casualties announced since our last issue:—

Killed.

Capt. R. H. Spittal, R.A.M.C., attached Lancashire Fusiliers, qualified at Aberdeen University, where he held the appointment of junior demonstrator of anatomy in 1905, and was in practice at South Bank, Yorks, before joining the R.A.M.C.

Lieut. D. S. E. Milligan, R.A.M.C., attached Worcester Regiment, was a student at St. Thomas's Hospital, London, where he held the appointment of casualty officer, and qualified in the early part of 1915.

Lieut. R. G. Hill, M.C., R.A.M.C., attached Coldstream Guards, received his medical education at St. Bartholomew's Hospital, London, where he was at one time senior house physician, and qualified in 1911. He also held an appointment at the Great Northern Central Hospital, and was a surgeon at the British Red Crescent Hospital during the Turco-Italian War of 1912. At the outbreak of the great war he obtained a combatant commission in the Royal Field Artillery, and served in France and in Egypt, and later was given a commission in the R.A.M.C. The award of the M.C. was recorded in THE LANCET of Oct. 6th, 1917, p. 550.

Capt. E. T. Gaunt, R.A.M.C., qualified at Birmingham in 1908, and held appointments at the General Hospital and at the Queen's Hospital, Birmingham.

Capt. G. S. Elliott, Australian A.M.C.

Capt. F. C. Davies, R.A.M.C., attached Northumberland Fusiliers, was educated at Cambridge and at Charing Cross Hospital, London, and qualified in 1908. He held appointments at Charing Cross, at West Ham Isolation, and at Great Ormond-street Hospitals, and was medical adviser to Cambridge Insurance Committee, and county tuberculosis officer at the time of joining the R.A.M.C.

Capt. A. M. Fisher, R.A.M.C.

Died of Wounds.

Capt. G. A. MacFarland, R.A.M.C., was educated at Belfast, Dublin, and Edinburgh, and qualified at the latter place in 1903. He was at one time assistant medical officer at Hackney Union Infirmary, and later practised in Belfast.

Lieut.-Col. A. W. F. Sayres, R.A.M.C., was a student at St. Thomas's Hospital, London, and qualified in 1890. He had held appointments at St. Thomas's and at the Bethlem Royal Hospital, London, and also at the South Devon and East Cornwall Hospital, Plymouth. He was attached to the R.A.M.C. (T.F.) prior to the outbreak of war, and was in practice at Hartley, Plymouth, where he was tuberculosis officer to the Stonehouse District of the Devonshire County Council.

Capt. R. Sherman, R.A.M.C., was a student at St. Bartholomew's Hospital, and qualified in 1912. He held a house appointment at St. Bartholomew's, and joined the R.A.M.C. in December, 1914. Shortly afterwards he went to France, and was present at the battles at Loos and on the Somme.

Capt. (temp. Lieut.-Col.) H. Gibson, R.A.M.C., received his medical education at the London Hospital, and qualified in 1907, and shortly afterwards joined the R.A.M.C.

Died.

Capt. R. Sterling, R.A.M.C., qualified at Durham in 1892, after taking holy orders in 1884. He was for many years a C.M.S. missionary in Palestine, and was an honorary canon of St. George's Collegiate Church, Jerusalem.

Major H. E. Dalby, R.A.M.C., was a student at Charing Cross Hospital, and qualified in 1899. He was in practice at Torquay before going on active service, and died at Basra, Mesopotamia, where he was in command of H.M. Hospital Ship, *Assaye*.

Wounded.

Capt. H. L. Flint, R.A.M.C., attached East Lancs Regiment.
Capt. J. H. Morris-Jones, R.A.M.C., attached Worcester Regt
Major W. E. Crowther, Australian A.M.C.
Capt. A. Nelson, New Zealand A.M.C.
Capt. D. A. R. Haddon, R.A.M.C., attached Royal Scots.
Capt. M. R. Finlayson, Australian A.M.C.
Capt. E. H. Griffin, M.C., R.A.M.C., attached Northumberland Fusiliers.
Capt. J. Tate, R.A.M.C., attached Royal Field Artillery.
Capt. W. E. Graham, R.A.M.C.
Capt. W. E. Hallinan, R.A.M.C., attached Royal Warwickshire Regiment.
Capt. R. F. Walker, R.A.M.C., attached Coldstream Guards.
Capt. G. T. Baker, R.A.M.C.
Lieut.-Col. P. J. Hanafin, D.S.O., R.A.M.C.

Capt. G. Crawshaw, R.A.M.C., attached East Lancs Regt.
Capt. H. Foxton, R.A.M.C.
Capt. H. A. Higginson, R.A.M.C., attached Lancs Fusiliers.
Capt. F. L. Newton, R.A.M.C., attached East Lancs Regt.
Capt. P. R. Woodhouse, M.C., R.A.M.C., attd. Irish Guards.

Previously reported Missing, now reported Prisoner in German Hands.

Lieut.-Col. G. S. Williamson, R.A.M.C.

THE HONOURS LIST.

The following awards to medical officers are announced. The acts of gallantry for which the awards were made are not yet announced. All are members of the R.A.M.C. unless otherwise stated. The dates in parentheses, in those cases where bars have been awarded, refer to the number of THE LANCET in which a record of the original decoration will be found :—

Bar to the Military Cross.

Temp. Capt. O. J. Day, M.C. (June 23rd, 1917, p. 969); Temp. Capt. A. Fullerton, M.C. (Jan. 6th, 1917, p. 38); Temp. Capt. N. J. H. Gavin, M.C. (June 9th, 1917, p. 894); Temp. Capt. A. J. R. O'Brien, M.C., African Med. Serv. (Feb. 17th, 1917, p. 279); Temp. Capt. D. J. S. Stephen, M.C. (July 31st, 1915, p. 257).

Military Cross.

Capt. J. Alston (Spec. Res.); Capt. R. R. G. Atkins (Spec. Res.); Temp. Capt. P. B. Belanger; Capt. T. H. Bell, Canadian A.M.C.; Capt. W. S. Birch (Spec. Res.); Temp. Capt. A. G. Bisset; Capt. A. Bloom; Temp. Capt. O. V. Burrows; Temp. Capt. C. K. Carroll; Capt. J. P. S. Cathcart, Canadian A.M.C.; Temp. Capt. J. P. Charles; Temp. Capt. A. T. Cunningham; Temp. Capt. L. M. Dawson; Temp. Capt. H. J. de Brent; Temp. Capt. C. K. G. Dick; Temp. Capt. J. Dickson; Capt. F. F. Dunham, Canadian A.M.C.; Lieut. L. du Vergé; Temp. Capt. H. H. Elliot; Temp. Capt. H. V. Forster; Temp. Capt. C. W. Fowler; Temp. Capt. J. H. C. Gatchell; Temp. Lieut. J. A. C. Greene; Capt. D. A. R. Haddon; Capt. J. L. Hamilton; Temp. Capt. D. C. Hanson; Temp. Capt. A. R. Jackson; Capt. C. L. Lander; Capt. H. D. Lane; Capt. P. MacCallum (Spec. Res.); Temp. Capt. D. J. Macdougall; Capt. A. E. P. McConnell; Capt. E. A. McCusker, Canadian A.M.C.; Temp. Capt. D. C. M. Page; Capt. A. A. Parker, Canadian A.M.C.; Capt. W. B. Postlewaite (Spec. Res.); Capt. J. W. G. H. Riddel; Capt. S. G. Ross, Canadian A.M.C.; Temp. Capt. W. Russell, Capt. J. B. Scott (Spec. Res.); Capt. W. H. Scott, Canadian A.M.C.; Temp. Capt. E. S. Sowerby; Temp. Capt. W. Turner; Lieut. S. Vidot (Spec. Res.); Temp. Capt. J. A. Vlasto; Capt. J. W. Woodley, Canadian A.M.C.

OBITUARY OF THE WAR.

ALFRED CECIL EDWARDS, M.B., CH.B. LIVERP.,
MILITARY CROSS,
CAPTAIN, ROYAL ARMY MEDICAL CORPS.

Captain A. C. Edwards, who died from the effects of shell-gas in hospital in France on July 25th, at the age of 37 years, was second son of the late Canon Edwards, of Bingley. He was educated at the Bradford Grammar School and at Queen Elizabeth's School, Kirkby Lonsdale, taking his medical course at Liverpool University, and graduating in 1908. After filling resident posts at the Northern Hospital and the South Dispensary in Liverpool, he entered the Colonial Medical Service. Receiving a commission in the R.A.M.C. early in 1915, he went to France in May of the same year as regimental medical officer, and remained at the front until his death in December, 1915, being awarded the Military Cross. His colonel writes of Captain Edwards as a most efficient regimental medical officer.

CHARLES WELLER, M.R.C.S. ENG., L.D.S.,
CAPTAIN, ROYAL ARMY MEDICAL CORPS.

Captain C. Weller, who was killed on active service on August 16th, at the age of about 35 years, was second son of Charles Weller, of Redhill. He was educated in France and took his dental course at Guy's Hospital, qualifying L.D.S. in 1905 and M.R.C.S. five years later. He then entered into partnership in a dental practice in London, which he gave up to join the Expeditionary Force in October, 1914, serving at the clearing hospital at Bethune, and later at Choate. He was then attached to a field ambulance in connexion with the 1st Cavalry Division, and on expiration of his second year, having signed on for the remainder of the war, he was at a base hospital until recently relieved by an American unit. At the time of his death he was medical officer to a London regiment. News was received at the regimental aid-post saying that some officers were buried inside a building which had been shelled. On his way to render assistance he received a severe wound in the temple, which he only survived for a few minutes.

Captain Weller was an excellent French scholar, and was also well known in the hunting field.

CASUALTIES AMONG THE SONS OF MEDICAL MEN.

The following additional casualties among the sons of medical men are reported :—

Private H. S. Edwards, Middlesex Regiment, killed in action, eldest son of Dr. A. S. Edwards, of Halling, Kent.
Capt. R. S. Adams, Royal Field Artillery, killed in action, only son of Dr. R. G. W. Adams, of Wellington, New Zealand.
Major H. E. Dalby, R.A.M.C., died, son of the late Dr. W. B. Dalby, of Torquay.
Second Lieut. J. M. De Lacey, West Yorkshire Regiment, attached Royal Flying Corps, killed in action, only son of Dr. R. C. De Lacey, of Newcastle-on-Tyne.
Second Lieut. R. C. D. Moore, H.A.C., killed in action, elder son of Capt. R. D. Moore, R.A.M.C., of Churchdown, Gloucester.
Capt. I. Heaton, Royal West Kent Regiment, died of wounds, son of Capt. C. J. Heaton, R.A.M.C., of Westgate-on-Sea.
Second Lieut. T. S. Arnold, East Surrey Regiment, attached Lancashire Fusiliers, died of wounds, elder son of Dr. F. S. Arnold, of Berkhamsted, Herts.
Col. H. G. F. Longhurst, Royal Berkshire Regiment, killed in action, youngest son of Dr. A. E. T. Longhurst, of Chandlersford, Hampshire.
Second Lieut. J. E. Beckingsale, Duke of Cornwall's Light Infantry, killed in action, only son of Dr. D. L. Beckingsale, of Towyn, Merioneth, Wales.
Capt. (temp. Lieut.-Col.) H. Gibson, R.A.M.C., died of wounds, younger son of Surg.-Lieut.-Col. G. J. Gibson, A.M.S. (ret.), of Totnes, Devon.

URBAN VITAL STATISTICS.

(Week ended Oct. 20th, 1917.)

English and Welsh Towns.—In the 96 English and Welsh towns, with an aggregate civil population estimated at nearly 17,000 000 persons, the annual rate of mortality was 12·0, against 11·1 and 11·8 per 1000 in the two preceding weeks. In London, with a population exceeding 4,000,000 persons, the death-rate was 12·9, or 0·9 per 1000 above that recorded in the previous week; among the remaining towns the rates ranged from 6·0 in East Ham, 6·3 in Acton and in Carlisle, and 6·8 in Bury, to 18·4 in Exeter, 19·9 in Lincoln, and 20·8 in Stockton-on Tees. The principal epidemic diseases caused 298 deaths, which corresponded to an annual rate of 0·9 per 1000, and included 178 from infantile diarrhœa, 54 from diphtheria, 33 from measles, 23 from whooping-cough, 8 from scarlet fever, and 2 from enteric fever. The deaths from diarrhœa, which had been 267, 278, and 243 in the three preceding weeks, fell to 178, and included 56 in London, 12 in Liverpool, 11 each in Sheffield and Hull, 10 in Manchester, and 7 in Birmingham. The 1021 cases of scarlet fever and 1314 of diphtheria under treatment in the Metropolitan Asylums Hospitals and the London Fever Hospital were respectively 97 and 43 above the numbers remaining at the end of the previous week. Of the deaths from all causes in the 96 towns, 118 resulted from violence. The causes of 31 deaths were uncertified, of which 5 were registered in Birmingham, 4 in South Shields, and 3 in Darlington.

Scotch Towns.—In the 16 largest Scotch towns, with an aggregate population estimated at nearly 2,500,000 persons, the annual rate of mortality was 12·1, against 10·7 and 11·8 per 1000 in the two preceding weeks. The 244 deaths in Glasgow corresponded to an annual rate of 11·4 per 1000, and included 10 from whooping-cough, 9 from infantile diarrhœa, 4 from diphtheria, and 2 from measles. The 104 deaths in Edinburgh were equal to a rate of 16·3 per 1000, and included 5 from infantile diarrhœa, 2 from whooping-cough, and 1 from diphtheria.

Irish Towns.—The 137 deaths in Dublin corresponded to an annual rate of 17·9, or 2·1 per 1000 above that recorded in the previous week, and included 7 from infantile diarrhœa, 2 from measles, and 1 each from enteric fever and whooping-cough. The 99 deaths in Belfast were equal to a rate of 13·1 per 1000, and included 3 from infantile diarrhœa, 2 from measles, and 1 from whooping-cough.

VITAL STATISTICS OF LONDON DURING SEPTEMBER, 1917.

In the accompanying table will be found summarised complete statistics relating to sickness and mortality in the City of London and in each of the metropolitan boroughs. With regard to the notified cases of infectious diseases it appears that the number of persons reported to be suffering from one or other of the ten diseases specified in the table was equal to an annual rate of 4·2 per 1000 of the population, estimated at 4,237,387 persons; in the three preceding months the rates had been 3·4, 3·5, and 3·1 per 1000 respectively. The lowest rates last month were recorded in Kensington, Hampstead, the City of London, Camberwell, Greenwich, and Woolwich; and the highest rates in Chelsea, Stoke Newington, Shoreditch, Bethnal Green, Southwark, and Bermondsey. The prevalence of scarlet fever showed a marked increase over that recorded in the preceding month; this disease was proportionally most prevalent in Chelsea, Finsbury, Shoreditch, Bethnal Green, Poplar, Bermondsey, Battersea, and Lewisham. The Metropolitan Asylums Hospitals contained 807 scarlet fever patients at the end of last month, against 595, 644, and 615 at the end of the three preceding months; the weekly admissions averaged 138, against 101 and 83 in the two preceding months. Diphtheria also was considerably more prevalent than it had been in the preceding month; the greatest proportional prevalence of this disease was recorded last month in Paddington, St. Marylebone, Stoke Newington, Shoreditch, Bethnal Green, Southwark, Bermondsey, and Deptford. The number of diphtheria patients under treatment in the Metropolitan Asylums Hospitals, which had been 1042, 1070, and 1003 at the end of the three preceding months, had risen to 1111 at the end of last month; the weekly admissions averaged 168, against 142 and 122 in the two preceding months. The prevalence of enteric fever was appreciably greater in September than in August; the 44 cases notified last month included 7 in Poplar, 7 in Wandsworth, 4 in Lambeth, and 3 in Kensington. There were 46 cases under treatment in the Metropolitan Asylums Hospitals at the end of the month, against 41 and 45 at the end of the two preceding months; the weekly admissions averaged 6 in each of the last two months. Erysipelas was proportionally most prevalent in Paddington, Holborn, Shoreditch, Bethnal Green, and Deptford. The 14 cases of puerperal fever notified during the month included 3 in Fulham, 2 in St. Pancras, and 2 in Stepney. Of the 12 cases of cerebro-spinal meningitis 3 belonged to Wandsworth, 2 to Hackney, and 2 to Camberwell; while of the 7 cases of poliomyelitis 2 belonged to Fulham.

The mortality statistics in the table relate to the deaths of persons actually belonging to the several boroughs, the deaths occurring in institutions having been distributed among the boroughs in which the deceased persons had previously resided. During the four weeks ending Sept. 29th, the deaths of 3582 London residents were registered, equal to an annual rate of 11·0 per 1000; in the three preceding months the rates were 12·0, 10·9, and 10·5 per 1000. The rates last month ranged from 6·6 in Woolwich, 7·8 in the City of London, 9·1 in Hampstead, 9·4 in St. Marylebone, 9·6 in the City of Westminster, 9·7 in Camberwell, and 9·9 in Paddington, to 12·9 in Stepney, 13·2 in Chelsea and in Southwark, 13·5 in Finsbury, 14·2 in Shoreditch, and 14·9 in Bermondsey. The 3582 deaths from all causes included 399, which were referred to the principal infectious diseases; of these, 23 resulted from measles, 4 from scarlet fever, 23 from diphtheria, 38 from whooping-cough, 9 from enteric fever, and 302 from diarrhœa and enteritis among children under 2 years of age. No death from any of these diseases was recorded last month in the City of London; among the metropolitan boroughs they caused the lowest death-rates in Kensington, the City of Westminster, Hampstead, Holborn, and Woolwich; and the highest rates in Fulham, Chelsea, Shoreditch, Bermondsey, Deptford, and Greenwich. The 23 deaths from measles were only half the corrected average; of these 23 deaths 7 belonged to Shoreditch, 3 to Stepney, and 2 each to Paddington, Chelsea, and Poplar. The 4 fatal cases of scarlet fever were 9 below the corrected average number, and included 2 in Finsbury and 1 each in Bethnal Green and Camberwell. The 23 deaths from diphtheria were 18 fewer than the corrected average number, and included 4 in Southwark, and 2 each in Paddington, St. Marylebone, Bethnal Green, and Wandsworth. The 38 fatal cases of whooping-cough were 4 below the corrected average, and included 4 in Bermondsey, 4 in Lambeth, and 3 each in Hammersmith, Islington, and Southwark. The 9 deaths from enteric fever were 1 in excess of the corrected average, and included 2 in Hammersmith, 2 in Poplar, and 2 in Wandsworth. The 302 fatal cases of diarrhœa and enteritis among children under 2 years of age were 342 less than the corrected average number; the greatest proportional mortality from this disease last month was recorded in Fulham, Chelsea, Shoreditch, Bermondsey, Deptford, and Greenwich. In conclusion, it may be stated that the aggregate mortality in London last month from these principal infectious diseases was 49·7 per cent. below the average.

ANALYSIS OF SICKNESS AND MORTALITY STATISTICS IN LONDON DURING SEPTEMBER, 1917.

(*Specially compiled for* THE LANCET.)

CITIES AND BOROUGHS.	Estimated civil population, 1916.	Notified Cases of Infectious Disease.											Deaths from Principal Infectious Diseases.								Deaths from all causes.	Death-rate per 1000 living.
		Small-pox.	Scarlet fever.	Diphtheria.*	Typhus fever.	Enteric fever.	Other continued fevers.	Puerperal fever.	Erysipelas.	Cerebro-spinal meningitis.	Poliomyelitis.	Total.	Annual rate per 1000 persons living.	Small-pox.	Measles.	Scarlet fever.	Diphtheria.*	Whooping-cough.	Enteric fever.	Diarrhœa and enteritis (under 2 years)	Total.	Annual rate per 1000 persons living.		
LONDON	**4,237,387**	—	**524**	**627**	—	**44**	—	**14**	**142**	**12**	**7**	**1370**	**4·2**	—	**23**	**4**	**23**	**38**	**9**	**302**	**399**	**1·2**	**3582**	**11·0**
West Districts:																								
Paddington	130,668	—	6	27	—	—	—	1	7	1	—	42	4·2	—	2	—	2	—	—	7	11	1·1	99	9·9
Kensington	152,144	—	10	6	—	3	—	—	6	1	—	26	2·2	—	—	—	—	1	1	1	3	0·3	118	10·1
Hammersmith	117,965	—	10	15	—	1	—	—	3	—	1	30	3·3	—	1	—	—	3	2	6	12	1·3	92	10·2
Fulham	149,428	—	17	18	—	2	—	3	5	—	2	47	4·1	—	—	—	—	2	—	20	22	1·9	125	10·9
Chelsea	57,298	—	17	8	—	1	—	1	2	—	—	29	6·6	—	2	—	1	—	—	7	10	2·3	58	13·2
City of Westminster	132,853	—	15	14	—	1	—	—	4	—	—	34	3·3	—	—	—	1	—	1	2	4	0·4	98	9·6
North Districts:																								
St. Marylebone	98,573	—	6	19	—	1	—	—	2	—	—	28	3·7	—	—	—	2	—	—	5	7	0·9	71	9·4
Hampstead	81,470	—	4	5	—	2	—	—	1	—	—	12	1·9	—	—	—	—	—	—	1	1	0·2	57	9·1
St. Pancras	196,812	—	25	35	—	2	—	2	8	1	—	73	4·8	—	1	—	1	1	—	8	11	0·7	168	11·1
Islington	309,359	—	38	36	—	2	—	1	11	—	—	88	3·7	—	—	—	1	3	—	20	24	1·0	260	11·0
Stoke Newington	49,776	—	6	17	—	—	—	—	—	—	—	23	6·0	—	—	—	—	—	—	5	5	1·3	40	10·5
Hackney	209,636	—	29	16	—	—	—	—	10	2	—	57	3·5	—	—	—	—	2	—	12	14	0·9	192	11·9
Central Districts:																								
Holborn	38,161	—	1	5	—	1	—	—	3	—	—	10	3·4	—	—	—	—	—	—	1	1	0·3	34	11·6
Finsbury	74,230	—	12	9	—	—	—	1	1	—	—	23	4·0	—	1	2	—	—	—	5	8	1·4	77	13·5
City of London	20,113	—	—	2	—	—	—	—	—	—	—	2	1·3	—	—	—	—	—	—	—	—	—	12	7·8
East Districts:																								
Shoreditch	99,932	—	21	23	—	—	—	1	5	—	—	50	6·5	—	7	—	1	2	—	19	29	3·8	109	14·2
Bethnal Green	115,552	—	31	40	—	—	—	—	9	—	—	80	9·0	—	—	1	2	1	—	9	13	1·5	93	10·5
Stepney	258,395	—	34	41	—	2	—	2	11	—	—	90	4·5	—	3	—	1	2	—	21	27	1·4	255	12·9
Poplar	155,095	—	32	19	—	7	—	1	5	—	1	65	5·5	—	2	—	1	2	2	11	18	1·5	143	12·0
South Districts:																								
Southwark	177,166	—	19	74	—	—	—	—	7	—	—	100	7·4	—	—	—	4	3	—	12	19	1·4	180	13·2
Bermondsey	113,661	—	27	38	—	—	—	—	3	—	—	68	7·8	—	—	—	1	4	—	25	30	3·4	130	14·9
Lambeth	283,729	—	24	31	—	4	—	—	8	1	1	69	3·2	—	1	—	1	4	1	16	23	1·1	237	10·9
Battersea	159,402	—	27	17	—	—	—	—	3	1	—	48	3·9	—	1	—	1	—	—	10	12	1·0	138	11·3
Wandsworth	310,858	—	45	34	—	7	—	—	2	3	1	92	3·9	—	—	—	2	2	2	21	27	1·1	238	10·0
Camberwell	249,749	—	16	22	—	1	—	—	7	2	1	49	2·6	—	—	1	—	2	—	19	22	1·1	185	9·7
Deptford	107,696	—	5	20	—	1	—	—	8	—	—	34	4·1	—	1	—	1	2	—	13	17	2·1	100	12·1
Greenwich	94,452	—	9	9	—	1	—	—	2	—	—	21	2·9	—	1	—	—	—	—	11	12	1·7	78	10·8
Lewisham	162,901	—	30	13	—	1	—	1	5	—	—	50	4·0	—	—	—	—	1	—	12	13	1·0	129	10·3
Woolwich	130,313	—	8	14	—	2	—	—	4	—	—	28	2·8	—	—	—	—	1	—	3	4	0·4	66	6·6
Port of London	—	—	—	—	—	2	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—

* Including membranous croup.

Medical News.

SOCIETY OF APOTHECARIES OF LONDON.—At examinations held recently the following candidates were successful in the subjects indicated:—

Surgery.—R. F. Deacon (Section II.), Guy's Hospital; E. A. Leak (Section I.), Cambridge and London Hospital; and I. Liberman (Sections I. and II.), Leeds.

Medicine.—J. L. D. Buxton (Sections I. and II.), University College Hospital; E. F. Deacon (Section II.) and A. Magill (Section I.), Guy's Hospital; J. S. Matthews, London and University College Hospitals; G. L. Mitchell (Sections I. and II.), Glasgow and Birmingham; and J. H. Tighe (Sections I. and II.), Birmingham.

Forensic Medicine.—J. L. D. Buxton, University College Hospital; O. Halstead, Guy's Hospital; J. S. Matthews, London and University College Hospitals; and J. H. Tighe, Birmingham.

Midwifery.—G. H. Fitzgerald and O. Halstead, Guy's Hospital; S. G. Mohamed, Liverpool; S. Robinson, Belfast and St. Thomas's Hospital; G. E. Spero, London Hospital; and T. C. Stephen, Manchester.

The diploma of the Society was granted to the following candidates, entitling them to practise medicine, surgery, and midwifery: J. L. D. Buxton, E. F. Deacon, I. Liberman, and J. S. Matthews.

ROYAL COLLEGE OF SURGEONS OF EDINBURGH.—At the annual meeting of the College on Oct. 18th the following office-bearers were elected for the ensuing year:—President: Robert McKenzie Johnston. Vice-President: James W. B. Hodsdon. Secretary and treasurer: George Mackay. Convener of museum committee: Charles Walker Cathcart. Librarian: Harold Jalland Stiles. President's Council: Francis Mitchell Caird, Sir George Andreas Berry, David Wallace, Henry Alexis Thomson, Harold Jalland Stiles, and Alexander Miles; *ex-officio*: The vice-president, the secretary and treasurer, and the Representative in the General Medical Council. Representative in the General Medical Council: James W. B. Hodsdon.

At a meeting of the College on Oct. 18th the following, having passed the requisite examinations between July 2nd and 4th, were admitted Fellows:—Henry Howard Christie, Wanganui, New Zealand; James Bertram Leather, Birmingham: Richard Parsons, Sandgate; Marion Columbus Pruitt, London; Henry Anthony Rippiner, Bradford; and David Welsh, Ambie, Northumberland.

THE SERVICES.

ROYAL NAVAL MEDICAL SERVICE.

C. H. A. Shepherd to be temporary Surgeon.

ARMY MEDICAL SERVICE.

Col. F. W. C. Jones, C.B., is placed on retired pay.

TERRITORIAL FORCE.

Major (temp. Lieut.-Col.) C. H. Lindsay, C.M.G., to be Assistant Director of Medical Services, and is granted the temporary rank of Colonel whilst so employed.

Lieut.-Col. H. H. C. Dent to be Assistant Director of Medical Services, and is granted the temporary rank of Colonel whilst so employed.

Capt. (temp. Major) H. J. Dunbar to be Deputy Assistant Director of Medical Services, Welsh Division.

ROYAL ARMY MEDICAL CORPS.

Lieut.-Col. (temp. Col.) P. MacKessack, D.S.O., relinquishes the rank of temporary Colonel on reposting.

Major (temp. Lieut.-Col.) C. W. Holden, D.S.O., to be an Assistant Director of Medical Services of a Division, and to retain his temporary rank.

Major (acting Lieut.-Col.) W. L. Steele retains his acting rank whilst in command of a General Hospital.

To be acting Lieutenant-Colonels: Major C. H. Carr and Temp. Major E. W. Skinner, whilst in command of a General Hospital; Major F. J. Garland, whilst in command of a Casualty Clearing Station; Capt. W. W. Boyce and Lieut. (temp. Capt.) R. A. Preston, M.C., whilst in command of a Field Ambulance.

Major W. L. Bennett is placed on the half-pay List on account of ill-health.

Major R. E. Humfrey to be acting Lieutenant-Colonel whilst in command of a Field Ambulance.

J. C. MacNeillie and S. Slack are granted temporary rank for duty with the South African Native Labour Corps as Major and Captain respectively.

Temp. Capt. B. L. Neiley, Canadian Army Dental Corps, to be temporary Major.

L. F. B. Knuthsen to be temporary Honorary Major whilst serving with No. 5 British Red Cross Hospital.

E. J. Tyrrell, late temporary Captain, to be Honorary Captain.

Temporary Lieutenants to be temporary Captains: A. McP. Warner, H. R. Mayo, W. C. Connell, H. N. Eccles, L. W. Evans, K. D. Attridge, V. D. C. Wakeford, N. W. Rawlings, J. E. Sharp, J. B. Martin, A. A. Henderson, H. L. Cronk, H. M. L. Crawford, H. S. Brown, R. Adam, W. Gemmill, T. E. R. Branch, W. Farquharson, R. H. Thomas, B. O. Kinney, J. Robertson, R. J. Harley-Mason, H. B. Weir, J. Robertson, C. E. O'Keeffe, F. Brickwell, J. C. Livett, H. L. Smith, G. D. Laing, F. M. Bishop, C. Elliott, A. J. Turner.

W. H. F. F. Godwin, late temporary Captain, is granted the honorary rank of Captain.

H. Nockolds to be temporary Honorary Captain whilst in charge of Queen Alexandra's Hospital.

To be temporary Captains: T. M. Creighton, T. M. Savage, S. J. Staples.

A. T. Paterson to be temporary Honorary Lieutenant whilst employed with the St. John Ambulance Brigade Hospital.

T. S. Evans to be temporary Honorary Lieutenant whilst serving with the British Red Cross Hospital, Netley.

P. E. el Howie, late temporary Lieutenant, is granted the honorary rank of Lieutenant.

S. H. Kagan to be temporary Honorary Lieutenant.

Officers relinquishing their commissions: Temp. Lieut.-Col. (Can. A.M.C.) T. McCrae; Temp. Capts.: E. N. Coutts (on account of ill-health contracted on active service), R. H. Oliver, R. Sterling (on account of ill-health), H. Hebblethwaite, L. S. Kidd, J. S. Findlay, J. K. Morton, H. J. Bell, T. B. Riddall, S. Bryson, G. H. Powell, E. Gordon, E. Seelly, J. F. Bullar, R. S. A. Heathcote, G. D. H. Wallace, C. H. W. Page, J. C. Bawden, R. N. Farrer, J. E. Rees, J. McTurk, J. Kirker, G. W. Lloyd, E. C. MacKay, P. Gettleson, J. Joule, R. P. Nash, W. T. Wearing, A. C. Falkiner, V. M. Fisher, W. Millerick, B. W. Gonin, A. Lindsay, L. W. Crowe, S. H. Hay, R. Marshall, F. L. Brown, A. Macintyre, T. D. Moffatt, S. A. Bull, D. T. H. Croly, A. F. Cole, A. B. MacLean, S. G. Dixon (on account of ill-health contracted on active service, and granted honorary rank of Captain), E. W. Braithwaite (on account of ill-health), K. B. J. Vickers (on account of ill-health). Temp. Lieuts.: J. F. Windsor, W. Shaw, G. L. Ranking, C. W. Coghlan, J. R. McFerran, L. Cohen, R. D. R. Allison, G. H. Hanna, W. S. Sheldon, G. A. Tiechurst, J. A. C. Doonan, G. L. Crimp, F. H. Wolfe, J. Longworth, H. Austin-Smith, J. R. Davies, J. W. Turner, J. Brownlee, P. A. Steven, C. F. P. Plunkett, H. W. B. Monteagle, W. Butterley (on account of ill-health), V. C. H. Dearden, J. A. Durante (on account of ill-health), W. Beckton, F. W. Waterworth, J. G. Fraser, E. A. W. English, E. G. D. Menzies, E. H. Drake, A. B. Rendel, W. A. Loxton, A. Reid, G. H. Rodolph, J. R. Thompson, A. J. Kearney, H. T. Evans, W. S. Darby.

SPECIAL RESERVE OF OFFICERS.

J. Michaelson, from Glasgow University Contingent O.T.C., to be Lieutenant.

TERRITORIAL FORCE.

Lieut.-Col. (temp. Col.) H. H. C. Dent relinquishes his temporary rank on vacating the appointment of Assistant Director of Medical Services, and is restored to the Establishment.

Major J. E. O'Connor relinquishes his commission on account of ill-health contracted on active service, and is granted the honorary rank of Major.

Major R. W. Forrest relinquishes his commission on account of ill-health, and is granted permission to retain his rank and wear the prescribed uniform.

Major (temp. Lieut.-Col.) C. H. Lindsay, C.M.G., is seconded whilst holding an appointment as Assistant Director of Medical Services.

Major E. L. Anderson, from Army Medical Service, to be Major.

Capt. (temp. Major) H. J. Dunbar is restored to the Establishment.

Capt. G. G. Plant, from Durham Light Infantry, to be Captain, and is granted the honorary rank of Lieutenant-Colonel.

Capt. A. H. Worrall, from Lincolnshire Regiment, to be Captain.

Capt. (temp. Major) (Brevet Major) D. W. Boswell relinquishes his temporary rank on alteration in posting.

Capt. D. E. Evans relinquishes his commission on account of ill-health, and is granted the honorary rank of Lieutenant-Colonel.

Capt. H. J. Robson relinquishes his commission on account of ill-health contracted on active service, and is granted the honorary rank of Captain.

Capt. (temp. Lieut.-Col.) N. C. Rutherford, D.S.O., from Field Ambulance, to be Captain.

Lieut. W. E. Porter, from Lincolnshire Regiment, to be Lieutenant.

C. S. Crichton (late Captain, R.A.M.C.) to be temporary Major, Surrey Medical Volunteer Corps.

T. H. Goodman to be temporary Lieutenant and Medical Officer, 5th Battalion, Suffolk Volunteer Regiment.

J. Hartigan to be temporary Lieutenant and Medical Officer, 1st Battalion, Glamorganshire Volunteer Regiment.

J. M. Martin to be temporary Lieutenant and Medical Officer, 4th Battalion, Gloucestershire Volunteer Regiment.

H. Farncombe (late Lieutenant, R.A.M.C.) to be temporary Lieutenant and Medical Officer, 3rd Battalion, Hampshire Volunteer Regiment.

F. McKenna to be temporary Lieutenant and Medical Officer, 1/1st Battalion, Ayrshire Volunteer Regiment.

W. O. Piper to be temporary Lieutenant and Medical Officer, 3/11th Battalion, Lancashire Volunteer Regiment.

D. Fenton to be temporary Captain and Medical Officer, 10th Battalion, Lancashire Volunteer Regiment.

J. E. Healey (late Lieutenant, R.A.M.C.) to be temporary Lieutenant and Medical Officer, 12th Battalion, Lancashire Volunteer Regiment.

J. A. H. Barnes (late Captain, I.M.S.) to be temporary Captain and Medical Officer, 1st Battalion, Leicestershire Volunteer Regiment.

H. Johnson to be temporary Lieutenant and Medical Officer, 2/9th Battalion, County of London Volunteer Regiment.

W. Robertson (late Captain, R.A.M.C. (T.)) to be temporary Captain and Medical Officer, 2/1st Battalion, Midlothian Volunteer Regiment.

H. Tipping (late Lieutenant, R.A.M.C.) to be temporary Captain and Medical Officer, 1st Battalion, Middlesex Volunteer Regiment.

E. H. Alton (late Lieutenant, R.A.M.C.) to be temporary Captain and Medical Officer, 3rd Battalion, Worcestershire Volunteer Regiment.

A. Wilson (late Major, 2nd E.R. of Yorks R.G.A. Volunteers) to be temporary Captain and Medical Officer, 1st Battalion, East Riding Volunteer Regiment.

P. Macdonald (late Lieutenant, R.A.M.C.) to be temporary Captain and Medical Officer, 22nd Battalion, West Riding Volunteer Regiment.

DEATHS IN THE SERVICES.

The death in India of Sir Charles Pardey Lukis, K.C.S.I., Director-General of Indian Medical Services, aged 60, is announced. He entered the Indian Medical Service in 1880 and served with the Mashood Wuzeeree Expedition in 1881 and with the Lohob Valley Expedition three years later. He became Civil Surgeon of Simla in 1899 and in 1905 was appointed principal and professor of medicine in Calcutta Medical College and senior physician at the College Hospital. In 1910 he was appointed Director-General.

Parliamentary Intelligence.

NOTES ON CURRENT TOPICS.

The Parliamentary Session.

PARLIAMENT resumed on Tuesday, Oct. 16th, after the autumn recess.

A Midwives Bill for Ireland.

Mr. DUKE, the Chief Secretary for Ireland, proposes to introduce a Midwives Bill for Ireland at an early date.

War Pensions Committees.

A Bill has been presented in the House of Commons by Mr. HODGE, the Minister of Pensions, for the purpose of providing for the inclusion on local committees constituted under the Naval and Military War Pensions Act of representatives of disabled men discharged from the Naval and Military Services of His Majesty. It has been read a first time.

HOUSE OF COMMONS.

TUESDAY, OCT. 16TH.

A Circular Memorandum.

Mr. PRINGLE asked the Under Secretary for War whether a confidential letter was issued by the Director-General of Medical Service in June to deputy directors of medical service with reference to expediting the discharge of wounded men from hospitals; and, if so, whether he would publish the letter.—Mr. MACPHERSON replied: My honourable friend is referring, I think, to a circular memorandum issued by the Deputy Director of Medical Services, Scottish Command, on June 26th last. I have ascertained that this circular was not based upon any special instructions from the War Office but upon general principles. As I said in debate on August 17th, I do not think that the interpretation placed upon it by my honourable friend is borne out by the complete text, a copy of which I will place in the library.

Instructions to Medical Boards.

Mr. BONAR LAW (Chancellor of the Exchequer) informed Mr. PRINGLE that the instructions to medical boards under the new authority had been drawn up and were now being printed. They would shortly be laid upon the table of the House.

Amendment of Insurance Act.

Answering Mr. HOGGE, who asked when it was proposed to introduce a new Insurance Bill, Sir F. CORNWALL (representing the National Insurance Commissioners) said: I hope to be in a position to give the desired information shortly.

Women Workers in V.A.D. Hospitals.

Mr. BENNETT-GOLDNE asked the Chancellor of the Exchequer whether he would take an early opportunity of making it known whether women workers and nurses voluntarily or for partial remuneration had undertaken all the arduous and various duties in connexion with Voluntary Aid Detachment hospitals for our wounded soldiers; whether he was aware that many thousands of these women had been carrying on their work for the whole period of the war, mostly unnoticed and often forgotten; whether he would remember that a number of them had continued to carry out their duties at serious sacrifices of both health and money; and, whether in the circumstances, he would make such humble representations to His Majesty as would favourably place before him the claims of these women who had already earned the national gratitude to some honourable but inexpensive recognition such as a distinctive ribbon, so that all those who merited it should be able to receive such an honour now instead of their being made to wait until some unknown period after the war when many of them might have been forced by illness, death, or other circumstances to cease their work.—Mr. BONAR LAW answered: The Government is fully aware of the facts to which my honourable and gallant friend refers in the first three parts of his question. As regards the last part he may rest assured that every endeavour is being made, in conjunction with the chairman of the Joint War Committee of the British Red Cross Society and the Order of St. John of Jerusalem and of the Central Joint Voluntary Aid Detachment Committee, to afford such recognition as is possible of the services of these ladies, and when final details respecting the award of the Order of the British Empire have been settled further particulars for the award will be available. I am informed that neither the War Office nor the other departments concerned regard with favour the suggestion that a distinctive ribbon should be instituted.

WEDNESDAY, OCT. 17TH.

Recruiting Medical Boards.

Mr. HOGGE asked the Parliamentary Secretary to the Ministry of National Service whether he could now state which of the recommendations of the Select Committee on Medical Boards the Government had adopted; and whether it was proposed to provide any means whereby men improperly passed into the Army could appeal their cases.—Mr. BECK replied: The organisation of recruiting medical boards is being transferred from the War Office to the Ministry of National Service. After a date early in November all men waiting to be called up for military service or holding a certificate of temporary or conditional exemption may claim to be graded by one of the National Service Medical Boards. Such re-examination will not interfere with a subsequent appeal to an appeal tribunal. The machinery for making appeals to appeal tribunals for re-examination will also be ready early in November. Medical assessors acting with the appeal tribunals will re-examine all men whose applications for re-examination are granted by the appeal tribunals. The finding of the appeal tribunal assessors will be final as regards a man's physical condition. The appeal tribunals and their assessors are to be administered by the Local Government Board. Attested men will have the same rights of appeal as unattested men.

THURSDAY, OCT. 18TH.

A Ministry of Health.

Answering Mr. DILLON, Mr. BONAR LAW (Chancellor of the Exchequer) said: The proposal of a Ministry of Health is under careful consideration. At present the various difficulties needing to be provided for in the establishment of such a Ministry have not reached any widely agreed solution, and as long as this is so it is not possible to undertake to introduce a Bill for the purpose. Steps, however, are being taken which will, it is hoped, secure substantial agreement amongst those who are actively engaged in the work of national health.

Mr. DILLON: If substantial agreement cannot be arrived at before the end of the session, will the right honourable gentleman give the House the opportunity of discussing this most important subject?—Mr. BONAR LAW: Perhaps the honourable Member will put down a question towards the end of the session and I shall be glad to answer it.

Soldiers Suffering from Lung Trouble.

Major HUNT asked the Chancellor of the Exchequer whether, in view of the fact that British and Irish troops suffering from lung trouble were not at present allowed to settle in the Dominions, and that there were considerable numbers of these troops suffering from lung trouble caused by service during the war and from gas attacks, and in view of the fact that the Ministry of Pensions had stated their inability to do anything to enable these men to go to and reside in a dry climate, as declared to be necessary by medical officers to prevent the development of tuberculosis, he could say whether the Government would apply to the Dominion governments for areas of land in their countries to be set apart for the purpose of settling these men in a dry climate and so saving their lives for the Empire.—Mr. BONAR LAW answered: The points suggested in my honourable friend's question are being considered.

Surgeon-General Sir W. Babtie.

Mr. KING asked the Under Secretary for War whether he could state the present position of those officers censured in the report of the Mesopotamia Commission; and what action the Army Council proposed to take.—Mr. MACPHERSON wrote in reply: I am afraid that I cannot add much to the answer which I gave to my honourable friend's question on this subject in August last. Surgeon-General Sir W. Babtie has submitted his explanation, the Army Council has found it satisfactory, and Surgeon-General Babtie has been recalled from leave and has resumed his official duties. The Council still awaits the explanations of the other officers concerned.

Medical Officers of the Territorial Force.

Colonel GRETTON asked the Under Secretary for War whether he was aware that a number of medical men joined the Territorial Forces as medical officers *à la suite* with the rank of captain, and that an undertaking was given that such officers should be promoted to the rank of major after eight and a half years' service; whether he was aware that this term expired in the case of a number of medical officers *à la suite* in June last and that no promotions had taken place; and whether it was intended to carry out the undertaking which was given at the time these officers joined the service.—Mr. MACPHERSON (in a written answer) replied: The answer to the first part of the question is in the negative. Officers appointed to the *à la suite* staffs of general hospitals serve under different conditions to other officers of the Royal Army Medical Corps, and promotion is not based on any qualifying time period.

Medical Service of the Expeditionary Force.

Colonel GRETTON asked the Under Secretary for War whether the Commission recently sent to examine into the medical service of the Expeditionary Force had yet reported; if not, when the report might be expected; and whether it would be laid upon the table of the House.—Mr. MACPHERSON wrote in reply: No report has been received, nor can I say when one will be in possession of the Army Council. I am

afraid that no promise to make the report public can be given in advance.

Dental Treatment of Soldiers.

In the course of replies to Mr. PENNEFATHER, Mr. MACPHERSON stated that the total number of commissioned dental officers in the Army was 517.

Physical Standards of Recruits.

Sir WILLIAM COLLINS asked the Parliamentary Secretary to the Ministry of National Service whether he would lay upon the table of the House the Memorandum which had been prepared containing directions as to the standards of physical fitness of recruits and the classification which was to supersede the present A, B, and C categories with their subdivisions.—Mr. BECK replied: The Memorandum asked for by my honourable friend is at present under the consideration of the Advisory Medical Board of the Ministry and will be presented to the House at an early date.

Exchange of Prisoners of War.

In the course of replies to Mr. HUME-WILLIAMS on the question of the exchange of prisoners of war, Mr. J. F. HOPE (representing the War Prisoners' Department) stated that no prisoners had yet been interned in Holland under the Hague agreement, but 800 prisoners had already been repatriated from Switzerland as a result of it. Swiss medical commissioners were now visiting Germany to select British prisoners of war for transfer to Switzerland. They had not yet, it was believed, completed their inspection, but once it was accomplished there should be no delay in the despatch of our men to Switzerland.

FRIDAY, OCT. 19TH.

Pay in the Royal Army Medical Corps.

Mr. JOYNSON-HICKS asked the Under Secretary for War what was the pay at home and abroad of a captain in the Territorial Royal Army Medical Corps and a lieutenant in the new Royal Army Medical Corps.—Mr. MACPHERSON replied: The pay and allowances of a captain in the Territorial Force, Royal Army Medical Corps, vary from 19*s.* to 22*s.* 2*d.* a day. The pay of a temporary lieutenant engaged on a contract basis is 24*s.* a day inclusive. The captain is entitled to a larger gratuity on cessation and to other advantages, but the question of the comparative emoluments is under the consideration of the Council.

Mr. JOYNSON-HICKS: Is the honourable gentleman aware that there is very grave dissatisfaction in the Territorial Medical Force in regard to this apparent discrepancy?—Mr. MACPHERSON did not reply.

MONDAY, OCT 22ND.

National Insurance Payments.

Mr. SNOWDEN asked the representative of the National Insurance Commissioners whether he was aware that the panel doctors in many parts of the country, especially in rural districts, had only received from 25 to 50 per cent. of the sums due to them for their services for the year 1916; and whether steps would be taken at once to pay up these outstanding arrears and thereby remove a sense of grievance under which these men were suffering.—Sir E. CORNWALL replied: In the great majority of cases the final payments of the doctors have been completed for the year 1916. In those areas where some balance of the year's remuneration is outstanding, the amount can only be small, as the sums which have been advanced monthly or quarterly during the year will have approximated to the total sums which will be found to be due on the final settlement. I think, therefore, the honourable Member must have been misinformed, but if he will furnish me with particulars of any cases which he has in mind I will cause inquiries to be made.

Imports of Opium.

Sir WILLIAM COLLINS asked the Parliamentary Secretary to the Board of Trade whether Indian opium was now largely used in this country in place of opium of Turkish or Persian origin for the manufacture of morphia and officinal preparations; and how much opium was used for these purposes in the year 1916 and what were the sources from which it was derived.—Mr. WARDLE wrote in reply: I am informed that for the last 18 months Indian opium has been practically the only description available for morphia manufacture, Persian supplies being relatively insignificant. The following statement shows the total net quantity of opium retained for use and manufacture in the United Kingdom in 1913 and 1916, and the countries from which it was originally consigned:—

Net Imports of Opium Retained.

Consigned originally from:—	1913. lb.	1916. lb.
India	4,824	437,237
Persia	35,020*	82,362
Turkey	270,123	25,843
Other countries	45,393	15,237

* Exports in excess of imports.

TUESDAY, OCT. 23RD.

Dental Service in the Army.

Colonel YATE asked the Under Secretary for War whether the dental service of the Army was in charge of a special director-general or of any recognised head of the dental service; what number of dentists were attached to each division; and, if less than one to each division, would he have arrangements made to complete to that strength.—Mr. MACPHERSON replied: The Director-General, Army Medical Service, is the recognised chief of the dental officers employed with the Army. There are no dentists in the war establishment of divisions, such officers being allotted to duties in the field at the discretion of the general officer commanding-in-chief, and it is not proposed to interfere with the discretion of these officers in this matter.

Medical Appliances in Mesopotamia.

Mr. E. WASON (on behalf of Sir J. JARDINE) asked the Under Secretary for War whether as regards the troops at all the stations on the Shatt-el-Arab, the Tigris, and Euphrates, he was in a position to assure the House that sufficient provision had been made for medical and surgical treatment, including medicines and appliances, and for the supply of fresh vegetables; and whether, and what, provision had been made of fruits.—Mr. MACPHERSON said in reply: The General Officer Commanding-in-Chief is responsible that sufficient provision is made for the medical and surgical treatment, including medicines and appliances for the troops at all stations in any particular theatre of war, and I have no reason to suppose that provision in Mesopotamia is not merely sufficient but ample in every respect. All demands for medical stores are promptly met, and in addition to the medical store depôts in Mesopotamia a special depôt has been established at Bombay to facilitate supply. The supply of fresh vegetables is good and amounts to 67 per cent. of the total vegetable ration. Fruit and dates are also available locally and issued to the troops.

Appointments.

Successful applicants for vacancies, Secretaries of Public Institutions, and others possessing information suitable for this column, are invited to forward to THE LANCET *Office, directed to the Sub-Editor, not later than 9 o'clock on the Thursday morning of each week, such information for gratuitous publication.*

BADGEROW, GEORGE W., Lieutenant-Colonel, C.A.M.C., has been appointed Honorary Consulting Surgeon in Diseases of the Throat and Ear to the South African Military Hospital, Richmond Park.

DUMMERE, H. H., M.R.C.S., L.R.C.P. Lond., Medical Officer to No. 4 District of Bromley.

ROBERTS, C. HUBERT, M.D., F.R.C.S., F.R.C.P., Temporary Assistant Physician-Accoucheur to St. Bartholomew's Hospital (for duration of the war).

Vacancies.

For further information regarding each vacancy reference should be made to the advertisement (see Index).

When the application of a Belgian medical man would be considered the advertisers are requested to communicate with the Editor.

ASHTON-UNDER-LYNE, DISTRICT INFIRMARY AND CHILDREN'S HOSPITAL.—House Surgeon. Salary £250 per annum, with board, &c.

BARNSLEY, BECKETT HOSPITAL.—Second Female House Surgeon. Salary £225 per annum, with board, &c.

BELGIAN CONGO.—Two Medical Officers. Salary £600 per annum and residence.

BOLTON INFIRMARY AND DISPENSARY.—Female Senior House Surgeon. Salary £300 per annum, with board, &c.

BRIDGWATER HOSPITAL.—House Surgeon. Salary £140 per annum, with board, &c.

BRIGHTON, ROYAL ALEXANDRA HOSPITAL FOR SICK CHILDREN, Dyke-road.—House Surgeon. Salary £200 per annum, with board, &c.

BRISTOL ROYAL INFIRMARY.—House Physician and House Surgeon. Salary at rate of £120 per annum, with board, &c.

BROMSGROVE, WORCESTERSHIRE ASYLUM, Barnsley Hall.—Temporary Assistant Medical Officer.

CHINGFORD, WALTHAMSTOW URBAN DISTRICT COUNCIL, HOSPITAL FOR INFECTIOUS DISEASES.—Resident Medical Officer. Salary £275 per annum, with board, &c.

DERBY, DERBYSHIRE SANATORIUM FOR TUBERCULOSIS, Walton Lane, near Chesterfield.—Resident Assistant Medical Officer. Salary £350 per annum, with board, &c.

HAMPSTEAD GENERAL AND NORTH-WEST LONDON HOSPITAL, Haverstock Hill, N.W.—Casualty Officer for six months. Salary at rate of £150 per annum, with board, &c.

LINDSEY (LINCOLNSHIRE), COUNTY OF THE PARTS OF.—Assistant Medical Officer. Salary £400 per annum.

LONDON FEVER HOSPITAL, Islington, N.—Resident and Assistant Resident Medical Officers. Salaries £300 and £180 per annum respectively, with board, &c.

LONDON TEMPERANCE HOSPITAL, Hampstead-road, N.W.—Medical Registrar. Salary at rate of 40 guineas per annum.

MANCHESTER CHILDREN'S HOSPITAL, Pendlebury, near Manchester.—Female Resident Medical Officer, unmarried. Salary at rate of £200 per annum.

MANCHESTER EDUCATION COMMITTEE.—Assistant School Medical Officer. Salary £300 per annum.

MANCHESTER MATERNITY AND CHILD-WELFARE CENTRES.—Female Medical Officer for Treatment of Children's Diseases. Salary £350 per annum.

MANCHESTER NORTHERN HOSPITAL FOR WOMEN AND CHILDREN, Parkplace, Cheetham Hill-road.—House Surgeon. Salary £150 per annum, with board, &c.

MANCHESTER ROYAL INFIRMARY.—Resident Surgical Officer, £225 per annum; Assistant Resident Surgical Officer; Accident Room House Surgeon; and Resident Medical Officer, Central Branch. £200 per annum each.

MINISTRY OF PENSIONS.—Medical Men to serve on Medical Boards.

QUEEN CHARLOTTE'S LYING-IN HOSPITAL, Marylebone-road, N.W.—Assistant Resident Medical Officer for four months and Senior Resident Medical Officer for a further four months. Salary at rate of £60 per annum and £80 per annum, with board, &c.

ROCHDALE INFIRMARY AND DISPENSARY.—Senior House Surgeon and Second House Surgeon. Salaries £400 and £200 per annum respectively, with board, &c.

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WALSALL AND DISTRICT HOSPITAL.—Female Assistant House Surgeon and Anæsthetist. Salary £175 per annum, with board, &c.

WOLVERHAMPTON AND MIDLAND COUNTIES EYE INFIRMARY.—House Surgeon. Salary £200 per annum, with board, &c.

THE Chief Inspector of Factories, Home Office, London, S.W., gives notice of a vacancy for a Certifying Surgeon under the Factory and Workshop Acts at Lytham in Lancashire.

Births, Marriages, and Deaths.

BIRTHS.

MACKENZIE.—On Sept. 15th, at Great Chart, near Ashford, Kent, the wife of Captain (Temporary Lieutenant-Colonel) D. F. Mackenzie, R.A.M.C., of a daughter.

MESSITER.—On Oct. 16th, at Cappely, Dudley, Worcs., Kona, the wife of Captain C. C. Messiter, R.A.M.C., of a daughter.

ROSS.—On Oct. 17th, at Coram Towers, Lyme Regis, the wife of Athole Ross, M.D., M.R.C.P., of a daughter.

SCOTT.—On Oct. 16th, at Lancaster-place, W.C., the wife of Captain E. Scott, D.S.O., R.A.M.C., a son.

MARRIAGES.

DAVIES—AKED.—On Oct. 20th, at St. Peter's, Harrogate, Arthur Davies, Captain, R.A.M.C., to Erica Violet, eldest daughter of Mr. and Mrs. H. E. Aked, Highgreen, Harrogate.

LANE—CLARK.—On Oct. 16th, at St. Augustine's, Stepney East, Captain Harold D. Lane, M.C., R.A.M.C. (T.F.), to Nellie Mary Louise, daughter of Lieutenant Colonel Clark, D.S.O., A.O.D.

LIVESEY—LIVESEY.—On Oct. 18th, at S. Mary, Buckland, Surgeon-Major E. W. Livesey, R.A.A. and E., of Alderney, Channel Islands, to Hilda Frances, third daughter of the late Frank Livesey, M.Inst.C.E., and Mrs. Livesey, of Buckland Corner, Reigate.

ORD—ZIANI DE FERRANTI.—On Oct. 20th, at the Church of the Holy Name, Manchester, William Erling Ord, M.D., R.A.M.C., to Vera Catherine Gertrude, second daughter of Dr. and Mrs. Ziani de Ferranti, of Hollinwood, and The Hall, Baslow, Derbyshire.

DEATHS.

DAVIES.—On Oct. 17th, killed in action, Captain Frederick Charles Davies, R.A.M.C., M.R.C.P., M.B., B.C., M.R.C.S., aged 33.

GIBSON.—On Oct. 17th, of wounds, Captain (Temporary Lieutenant-Colonel) Harold Gibson, R.A.M.C., aged 33.

HILL.—On Oct. 11th, killed in action, Lieutenant R. Gordon Hill, R.A.M.C., M.C., Coldstream Guards.

NICHOLSON.—On Oct. 15th, Tom M. Nicholson, M.A. Oxon., M.R.C.S., L.R.C.P. Lond., after great suffering, heroically borne.

SAYRES.—On Oct. 10th, of wounds received July 17th, Alexander Ward Fortescue Sayres, Lieutenant-Colonel, R.A.M.C. (T.F.), of Fern Bank, Hartley, Plymouth.

SIMPSON.—On Oct. 18th, at Southgate-road, N., after a few days' illness, Dr. C. Stanley Simpson.

STERLING.—On Oct. 16th, at a nursing home, Captain Robert Sterling, M.A., M.B., B.S., R.A.M.C., hon. Canon of St. George's Collegiate Church Jerusalem, for 24 years a missionary of the C.M.S., Gaza, Palestine, aged 58.

N.B.—A fee of 5s. is charged for the insertion of Notices of Births, Marriages, and Deaths.

The following journals, magazines, &c., have been received:—Canadian Medical Association Journal, Therapeutic Gazette, British Journal of Dental Science, Philippine Journal of Science, Boletin de Medicina é Higiene, Duodecim, St. Paul Medical Journal, Hospital Gazette, Medical Officer, Boletin del Hospital del Salvador Santiago de Chile, Maternity and Child Welfare, Journal of Comparative Pathology and Therapeutics, Bulletin of the Johns Hopkins Hospital, Journal de Médecine de Bordeaux, Archives of Radiology and Electrotherapy.

Medical Diary for the ensuing Week.

SOCIETIES.

ROYAL SOCIETY, Burlington House, London, W.

THURSDAY.—Lord Rayleigh, O.M.: On the Reflexion of Light from a Regularly Stratified Medium.—Sir William Abney, K.C.B.: Two Cases of Congenital Night-blindness.—Hon. R. J. Strutt: Duration of Luminosity of Electric Discharge in Gases and Vapours: Further Studies.—Mr. G. W. Walker: Surface Reflexion of Earthquake Waves.—Dr. H. S. Allen: Characteristic Frequency and Atomic Number (communicated by Prof. O. W. Richardson).

ROYAL SOCIETY OF MEDICINE, 1, Wimpole-street, W.

MEETINGS OF SECTIONS.

Friday, Nov. 2nd.

LARYNGOLOGY (Hon. Secretaries—W. D. Harmer, Frank A. Rose): at 4 P.M.
Presidential Address.
Cases.

ANÆSTHETICS (Hon. Secretaries—F. E. Shipway, Ashley S. Daly): at 8.30 P.M.
Paper:
Lieut.-Col. J. F. Silk, R.A.M.C.: The Administration of Anæsthetics in Home Military Hospitals.
Demonstration:
Dr. Hugh R. Phillips: Apparatus for Administering Chloroform and Ether with Oxygen.

MEDICAL SOCIETY OF LONDON, 11, Chandos-st., Cavendish-sq., W.

MONDAY.—8.30 P.M., Paper: Capt. H. E. Boyle, R.A.M.C. (T.): Experiences in the Use of Nitrous Oxide and Oxygen with Regulated Re-breathing in Military Surgery at the First London General Hospital.

LECTURES, ADDRESSES, DEMONSTRATIONS, &c.

POST-GRADUATE COLLEGE, West London Hospital, Hammersmith-road, W.

MONDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Gray: Operations. Mr. B. Harman: Diseases of the Eye. Dr. Simson: Diseases of Women.

TUESDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Baldwin: Operations. Dr. Banks Davis: Diseases of the Throat, Nose, and Ear. Dr. Pernet: Diseases of the Skin.

WEDNESDAY.—10 A.M., Dr. Arthur Saunders: Diseases of Children. Dr. Banks Davis: Operations of the Throat, Nose, and Ear. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Pardoe: Operations.

THURSDAY.—2 P.M., Medical and Surgical Clinics. X Rays. Mr. Gray: Operations. Mr. B. Harman: Diseases of the Eye.

FRIDAY.—10 A.M., Dr. Simson: Gynæcological Operations. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Baldwin: Operations. Dr. Banks Davis: Diseases of the Throat, Nose, and Ear. Dr. Pernet: Diseases of the Skin.

SATURDAY.—10 A.M., Dr. Arthur Saunders: Diseases of Children. Dr. Banks Davis: Operations of the Throat, Nose, and Ear. Mr. B. Harman: Eye Operations. 2 P.M., Medical and Surgical Clinics. X Rays. Mr. Pardoe: Operations.

METEOROLOGICAL READINGS.

(Taken daily at 8.30 a.m. by Steward's Instruments.)

THE LANCET Office, Oct. 24th, 1917.

Date.	Rainfall.	Solar Radiation Vacuo.	Maximum Temp. Shade.	Min. Temp.	Wet Bulb.	Dry Bulb.	Remarks.
Oct. 18	...	81	55	35	42	43	Fine
,, 19	0·15	79	53	40	43	44	Cloudy
,, 20	...	74	55	40	43	44	Fine
,, 21	...	85	58	43	45	48	Fine
,, 22	...	90	59	47	47	47	Fine
,, 23	0·07	92	54	46	48	50	Cloudy
,, 24	...	62	49	38	38	40	Fine

Other information which we have been accustomed to give in these "Readings" is withheld for the period of the war.

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IT is most important that communications relating to the Editorial business of THE LANCET should be addressed *exclusively* "TO THE EDITOR," and not in any case to any gentleman who may be supposed to be connected with the Editorial staff. It is urgently necessary that attention should be given to this notice.

It is especially requested that early intelligence of local events having a medical interest, or which it is desirable to bring under the notice of the profession, may be sent direct to this office.

Lectures, original articles, and reports should be written on one side of the paper only, *and when accompanied by blocks it is requested that the name of the author, and if possible of the article, should be written on the blocks to facilitate identification.*

Letters, whether intended for insertion or for private information, must be authenticated by the names and addresses of their writers—not necessarily for publication.

We cannot prescribe or recommend practitioners.

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SUPPLEMENT to THE LANCET, October 27, 1917

METEOROLOGICAL OFFICE

Advisory Committee on Atmospheric Pollution

REPORT ON OBSERVATIONS IN THE YEAR 1915-1916

Forming the Second Report of the Committee for the Investigation of Atmospheric Pollution

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INTRODUCTION.

SINCE the publication of the Committee's first Report, for the year 1914–15, some difficulty has been experienced owing to lack of funds. It will be remembered by those who have read the Report above referred to that this Committee is a purely voluntary body, relying for funds upon outside support. The work falls into two main divisions:—

(1) The organisation of the whole scheme, preparing designs of gauges and instructions for their operation as well as for analysis of deposit; collecting, filing, tabulating, discussing and publishing the results, and generally controlling and coördinating the work.

(2) The establishment and operation of the gauges, collection and analysis of deposit, and the sending of monthly returns to the Committee.

The cost of No. (2) is borne by the observing stations, and is a very important item, amounting to about £1000 for the year, without counting the cost of providing and installing the gauges. The trouble has been to finance No. (1), as it is hardly to be expected that the bodies which bear the cost of No. (2) should also bear that of No. (1).

In view of the above considerations, application was made to the Department of Scientific and Industrial Research for a Government grant in aid of the work included under No. (2), and the Committee have now gratefully to acknowledge the generous help given to them by the Department.

Not only have their financial difficulties been met by a substantial grant, but the work has been given official approval and status by placing it under the control of the Meteorological Office. The Committee has been constituted an "Advisory Committee on Atmospheric Pollution" to the Meteorological Office, and its original title has been altered accordingly. At the same time little change in the personnel has been made, with the exception that the Department of Scientific and Industrial Research have power to appoint a representative, and it has also been decided to ask each coöperating authority to appoint a representative. It will thus be seen that a new impetus has been given to the work, and although, strictly speaking, the changes which are above indicated took place during 1917, yet as their effect is retrospective, as above indicated, it appeared best to set them forth here.

It was originally intended, on receipt of the grant above mentioned, to publish the Reports for 1915–16 and 1916–17 at the same time, as the latter year's returns are practically all in. Further consideration indicated the advisability of placing the 1915–16 results before the public at the earliest possible moment, instead of delaying them to incorporate the 1916–17 results in the same Report. It was therefore decided to do this, but it is hoped that the publication of the third Report will not be delayed more than two or three months behind the present one. And future Reports should be made public very shortly after the conclusion of each year's observations on March 31st.

The Committee felt that the question of carrying on its work and that of the observing stations during the war required very careful consideration, and, after full discussion, it was decided that it would be inadvisable to stop the work during the war if it could be carried on. In coming to this decision the importance of continuity in the collection of such statistics was kept in mind, as well as the advantages which would arise from having all the data on atmospheric pollution ready by the time peace returned, when people's minds would again find interest in more peaceful problems.

The connexion between atmospheric pollution and fuel economy was not lost sight of, and at a time when this is of such vital importance as the present the loss of combustible matter represented by the soot suspended in the air appeared a legitimate subject for investigation.

In considering the subject from the point of view of fuel economy it is interesting to note that, taking the case of the County of London alone for the year 1915–16, and basing the figure upon the average returns from the different observing stations, the total quantity of matter deposited from the air during the year on London was approximately 54,200 tons, and by reference to the figures shown in the tables it will be seen that this deposited matter is, to a great extent, derived from fuel waste in the form of smoke. The six months April to September were responsible for about 24,900 tons, and the six months October to March 29,300 tons. Not only is it necessary at present to scrutinise carefully every source of waste, but it is equally necessary to conserve the health and physical energy of the people. It may not be out of place in this connexion to mention that the approximate quantities of air, solid food, and water required by an adult human being per day are:—

Air	30 lb.
Food	2·7 „
Water	4·5 „

In the first Report, for the year 1914–15, maps were given showing the positions of the deposit gauges for the stations then at work; in the present Report, therefore, these maps have not been reproduced, but in the case of new observing stations not already included in the previous Report maps are now given (pp. xix. and xx.) and the position of each gauge is indicated in a similar way to that adopted in the 1914–15 Report—that is, a black circle 1 inch in diameter is placed upon the map so that its centre coincides with the position of the deposit gauge.

It has been naturally unavoidable that owing to the pressure of other work and the depletion of staffs arising from the war certain stations have found it impossible to continue observations, so that the list of observing stations for the year under consideration will be found considerably curtailed as compared with the preceding year. It may be stated, however, that the cessation of observations is in most cases only temporary, and it is confidently expected that when peace conditions return the work of collecting, analysing, and reporting the results will be again resumed in most of the stations referred to.

STANDARD GAUGE.

The standard deposit gauge, fully described in the first Report, has continued to fulfil its function satisfactorily. Certain difficulties have, however, become apparent during the course of the investigation. For example, the porcelain glaze of the collecting vessels has in one case shown a slight solubility in water, with an accompanying addition to the collected water of the material from the enamel. This has, however, been very slight, and where it has occurred there has been no difficulty in separating the constituent derived from the glaze, such as lead, from those normally deposited from the atmosphere. This difficulty has only been noticed in the case of one gauge—that of York; and although the presence of lead in the water was at first attributed to contamination from the lead paint which coated the outside of the gauge vessel, it was subsequently found that the source of the lead was the enamel coating the inner, or catchment, surface of the vessel. Of course, it would be preferable to have an insoluble enamel for this purpose if it were possible to obtain it, but the contamination fortunately being due to a material not normally present in the atmosphere does not affect the results.

Again, during the winter of 1915 several months' observations were lost owing to bursting of the bottles by frost. This is, however, difficult to avoid, as in an exposed position no amount of protection by jacketing or enclosing is sufficient to prevent the water freezing when there is a long-continued frost, although for frosts of short duration enclosing the collecting bottles in a wood casing surrounding the stand of the gauge is an effective protection.

The efficiency of this gauge has been criticised on the ground that the rainfall governs the amount of impurity collected, and that the gauge does not measure the total impurity present in the air, since this is not all deposited, some remaining in suspension.

It therefore becomes important to point out that the primary function of the gauge is to collect deposited impurity so as to compare the measurements of the amounts which fall in different localities. The amount collected is not the same as the amount in the air at any one time, but in the long run the greatest amount is likely to be found in the gauge which is exposed to the atmosphere richest in pollution. Naturally rainwater is also collected, but the gauge does not depend on rain for its action, as in dry weather it also collects whatever falls into its catchment area.

The fact that measuring deposited impurity cannot provide complete information as to the degree of atmospheric pollution is very obvious. This point was carefully considered by the Committee at the start, and was dealt with in their first Report under "Methods of Work." It is therefore unnecessary to go over the ground again now, but it may be well to indicate that although a complete statement as to air pollution should deal with suspended as well as deposited matter, the measurement of either alone may be very valuable.

In order to obtain information relative to the very finely-divided matter which remains suspended in the air for long periods, the Committee have adopted a standardised form of filter, and this is available for the use of those who wish to obtain more complete information than measurement of deposit alone can give. This filter permits of taking an observation in about 10 minutes and has been exhaustively tested and calibrated.

Relative to the criticism that the rainfall governs the deposit, it will be shown in the present Report that this is not the case. The whole question of the relation of deposit to rainfall has been dealt with rather fully, and it will be seen that while the quantity of soluble matter deposited is evidently affected by the rainfall, this is not true to anything like the same extent for the insoluble parts of the deposit.

ANALYSES.

Since issuing the last Report the Committee have had the advantage of a wide experience as regards the chemical procedure. Several difficulties were encountered, but the more important of them have been investigated, and where it appeared advisable, from the point of view of scientific accuracy, the "Instructions for Analysis" have been revised.

It has been thought that an account of this part of the work will be of interest, and also useful in the criticisms of the compiled data, and with this in view it has been included in the present Report.

The Committee have received from several of the chemists who are coöperating in the investigation some suggestions and criticisms, and wish to take this opportunity of expressing their appreciation of the assistance derived from them. A Sub-Committee was appointed to inquire into the chemical procedure and to make such recommendations to the Committee as appeared necessary in the light of more than a year's experience.

In its investigations the Sub-Committee had the advantage of making use of the gauges in the County of London, and for this they are indebted to Dr. W. H. Hamer, the Medical Officer of Health to the London County Council, who kindly allowed the Council's chemist, Mr. J. H. Coste, to coöperate.

Errors and Difficulties arising from Algal Growths.

Mr. A. R. Tankard, of Hull, drew the attention of the Committee to this matter. The algal growth rendered filtration a tediously slow process, and to some extent was a source of error in the determination of undissolved matter and ammonia. It seemed highly desirable that some steps should be taken to prevent this growth.

Several methods were suggested, the chief of which were: the use of

1. Formaldehyde.
2. Mercuric chloride.
3. Metallic copper.
4. Copper sulphate.

Mr. Tankard kindly undertook to investigate the effect of formaldehyde. It was anticipated by him that the ammonia determination might be interfered with, but, owing to the great dilution, it was thought that this would not occur to a serious extent. His experiments proved, however, that the ammonia almost entirely disappeared. In a particular case he showed that water containing 0·006 gramme ammonia per litre contained only one-tenth of this amount after three weeks in the presence of formaldehyde (1 part in 20,000). In another case 0·0007 gramme of ammonia per litre was reduced in two weeks to 0·00014 gramme. It was, therefore, concluded that the use of formaldehyde was not permissible.

On the other hand, Mr. Tankard made some interesting observations on the change in the ammonia contents of the water in the absence of formaldehyde. To quote his own remarks:—

"In the absence of formaldehyde the ammonia in rain-water tends at first to diminish in amount, but after a lapse of time a rapid growth of fungus sets in and the amount begins to increase in some cases. For instance, the August rain-water here contained 0·0006 gramme per litre when first examined; a week later the amount was 0·0005 and a fortnight after the first determination the amount had fallen to 0·0003; then the quantity of ammonia began to increase and ten days later still had risen to 0·0005 gramme per litre. As the growth of fungus, both in rapidity and amount, will depend upon a number of factors not readily controllable it cannot be stated that at the end of the monthly period the ammonia found will be a correct indication of the amount washed down from the atmosphere."

Mercuric Chloride.—This was considered by the Sub-Committee, but in view of its uncertain behaviour when exposed to heat during the process of analysis it did not seem very promising. Allowance would, of course, have to be made in the analysis for the mercuric chloride added.

Metallic Copper.—The growth of bacteria in the water contained in gas-holder tanks and similar apparatus has been the subject of investigation in connexion with the operation of gas-making plant, and it has been observed that these bacteria can decompose dissolved sulphates with the evolution of H_2S. A point that was observed was that the presence of metallic copper prevented in a large measure the development of bacterial growth. Probably minute traces of a copper salt were formed by the action of the water upon the metal and dissolved in the water, sufficient to prevent within a certain radius of the metal the growth of the bacteria.

It was suggested that if a wire spiral or a strip of pure copper were suspended from the cork of the collecting bottles the growth would be prevented. The dissolved sulphates in the water would probably form copper sulphate with the metal, and this would act as an antiseptic. In this case no correction would be necessary for the SO_3, but a small deduction from the total solids and total dissolved matter would have to be made owing to the small quantity of copper added.

After considering this from all points of view it was decided not to adopt it for the following reasons:—

1. Probably both sulphate and carbonate of copper would be formed, thus complicating matters.
2. Additional work would be involved in the separate determination of the amount of copper in solution in the water.

Copper Sulphate—After considering all aspects of the question the Sub-Committee concluded that copper sulphate seemed to be the best method of dealing with the difficulty. Past investigations indicate that one part of the crystalline salt per million of the water is sufficient to prevent growth, and working on this basis the Sub-Committee have inserted a new paragraph in the "Instructions for Analysis." It was therefore prescribed in the revised "Instructions" that a measured quantity of a standard solution of copper sulphate be added to each of the collecting bottles so as to ensure the presence of this salt to the extent of not less than one part per million. A small correction is necessary on account of the added salt, but this involves nothing more than a simple subtraction from the figures for the total dissolved solids and the sulphate.

The use of copper sulphate has proved entirely satisfactory both by general and microscopic observation. In one case a parallel experiment was made on two samples of the same water, one sample of water having added to it copper sulphate to the extent of one part per million. Whereas the untreated sample showed copious algal growth after two weeks' exposure, the treated sample remained unaltered.

Filtration.—In addition to the avoidance of errors the prevention of algal growth was desirable on the score of easy filtration. However, even in the absence of algæ, &c., it is a tedious process to pass the whole volume of collected water through the filter. Mr. J. F. Liverseege in a letter to the Committee suggested decantation after thorough settling. Some experiments have recently been made in London, and it appears that decantation is quite permissible. The amount of suspended matter remaining in the water collected in the London gauges after standing for four days was found to be quite unweighable; in fact, slightly

negative results were found on filtering the clear supernatant liquor. Decantation is therefore prescribed in the revised "Instructions."

Drying Temperature for Dissolved and Undissolved Matter.—The original instructions prescribed 105° C. for this. In view of the greater convenience of 100° C., it was considered advisable to ascertain if any error would be involved in the change. The following observations on London rainfall show the relation between these two temperatures:—

Weight of undissolved matter after drying at 100° C.	1951	milligrammes.
Weight after further drying at 105° C.	1935·5	,,
Extra loss due to further drying at 105° C.	15·5 = 0·8 per cent. of undissolved matter.	
Weight of dissolved matter after drying at 100° C.	1967	milligrammes.
After further drying at 105° C.	1967	,,
Loss	Nil.	

In view of these facts there seemed no need for insistence on 105° C., and therefore 100° C. is prescribed in the revised "Instructions."

Chlorine.—In view of the greatly diluted character of this constituent it was thought that the usual process of titration might involve errors owing to the solubility of the silver chromate. Direct comparison with Volhard's method indicated that no serious error existed. It was therefore considered unnecessary to alter the method originally prescribed except to suggest that concentration should precede titration.

Ammonia.—It was suggested by Mr. Tankard that the ammonia might be more accurately determined by Nesslerising direct instead of after distillation, as was originally prescribed.

This point has been carefully investigated, and it has been found that under suitable conditions practically the same result is obtained by any one of the three methods referred to. The following are some actual observations on the same sample of water:—

By distillation and titration... ...	26·5	milligrammes NH_3
,, ,, Nesslerisation	25·7	,, ,,
,, direct Nesslerisation	26·4	,, ,,

For direct Nesslerisation it is, of course, necessary that the water should not be appreciably coloured.

In view of these results full discretion has been given to the analyst in the revised "Instructions."

Ash of Soluble Matter.—Section 8 of the revised "Instructions" provides for the addition of ammonium carbonate after ignition. This arose out of a suggestion by Mr. J. F. Liverseege. The ignition of the residue would tend to decompose any soluble carbonates in the original soluble matter.

The advisability or otherwise of the use of ammonium carbonate would therefore depend upon the chemical character of the residue. In a particular case this residue obtained from one of the London gauges was found to be made up as follows:—

Sodium sulphate	1·227	grammes.
Calcium ,, ...	0·329	,,
Calcium carbonate...	0·530	,,
Sodium chloride	0·178	,,

and clearly pointed to the advisability of using ammonium carbonate.

Tarry Matter.—In the original "Instructions" this was considered to be the loss of weight due to extraction with CS_2.

A question arose as to whether this could not be more accurately determined by the direct weighing of the matter extracted by CS_2, but investigation has shown that the extracted matter gains weight on drying, due probably to the oxidation of small quantities of free sulphur and sulphur compounds in the tar. The method of determination originally prescribed was therefore retained.

The following are the results of observations in London stations:—

Station.	Tar by "difference."	Tar by direct weighing.
Embankment Gardens ...	0·153 grammes	0·161 grammes.
Finsbury Park	0·220 ,,	0·233 ,,

Other Points.—In revising the "Instructions" attention was directed to methods of sampling, quantities of the liquid to be used for various estimations, and to the return of sulphates in terms of SO_3 instead of SO_4.

While it is too much to hope that the "Revised Instructions for Analysis" are entirely free from objection, it is believed that they do not leave room for any serious errors.

"REVISED INSTRUCTIONS FOR ANALYSIS" OF RAIN WATER AND SOLIDS DEPOSITED IN THE STANDARD GAUGE, ISSUED JANUARY, 1916.

1. The bottles containing the collected rainfall should be properly labelled with name and number of station and the period of collection, and should be kept standing at the laboratory for several days until completely settled. The approximate volume of the liquid should be ascertained at the time of receipt.

UNDISSOLVED MATTER.

2. The whole of the amount collected should be used for estimating the suspended UNDISSOLVED MATTER.

Filtration.—3. If the bottle has been allowed to stand for a sufficient time to allow the liquid to become clear, there will be no necessity for the whole volume to be filtered. The clear portion can be carefully decanted off by means of a syphon tube inserted so as to reach to within one inch of the bottom of the bottle. The bottle should stand at a height above the vessel in which the decanted liquid is to be collected, sufficient for the easy and adjustable discharge of the flow.

The filtering medium which has given the best results consists of a layer of pulped filter paper suitably disposed in a Gooch crucible. The Gooch crucible should be fitted by means of an adapter to a filtering flask having a side tube for connexion to a vacuum pump.

The filter is prepared by weighing a 12·5 cm. filter paper or by tareing it against another paper of the same size and heating this with about 200 c.c. of the decanted liquid. By violently shaking this, a very finely divided pulp is produced, and part of this is placed in the Gooch crucible and lightly pressed down by means of a glass rod with a flattened end. Gentle suction is then applied and the filter is ready for use. Should it get clogged up, the pulp, together with any solids collected upon it, may be removed and kept for further treatment, and a fresh filter made my placing some clean pulp upon the crucible.

Having decanted off the clear liquid to within one inch of the bottom of the bottle, the remaining turbid part must be shaken up and transferred to the filter, the bottle being washed out with some of the decanted liquid with the aid of a clean long-handled test-tube brush. Any paper pulp left over or previously removed is then put on the top of the matter collected in the crucible. Should there be more than one bottle of collected rainfall, each should be dealt with in the manner described, the whole of the pulp and the filtered matter being finally placed together in the Gooch crucible for subsequent treatment.

Undissolved Matter.—4. The Gooch crucible, after its contents have been washed with distilled water, is dried to constant weight; the difference between this weight and the weight of the empty crucible, plus filter paper, representing the TOTAL UNDISSOLVED MATTER. A temperature of 100° C. is sufficient for this.

Tarry Matter.—5. The crucible is then placed in an extraction apparatus and contents extracted with Carbon-bi-Sulphide. The difference found after drying at a 100° C. represents the TARRY MATTER.

Ash.—6. The residue from above is ignited for the determination of Ash. Care must be taken that any particles which might possibly drop through the holes in the crucible are not lost. The residue after ignition is the ASH of the UNDISSOLVED MATTER, and the loss is the COMBUSTIBLE MATTER insoluble in CS_2. (Allowance, of course, being made for the filter paper.)

DISSOLVED MATTER.

In the determination of DISSOLVED MATTER it will be necessary to reserve about eight litres of the decanted liquid. In the event of there being two or more station bottles, a proportional quantity should be taken from each bottle so that when the separate quantities are added together the mixture will represent a true average of the whole of the liquid collected.

Loss on Ignition and Ash.—7. One litre (or smaller quantity if there is a large proportion of dissolved solids present) of the decanted liquid is evaporated to dryness on a water bath and afterwards dried at 100° C. to constant weight. The residue is TOTAL DISSOLVED SOLIDS.

The residue is ignited at a dull red heat until all combustible matter has been consumed, then moistened with Ammonium Carbonate and again gently ignited.

Loss is "LOSS ON IGNITION" of matter dissolved in water.
Residue is "ASH" or inorganic matter dissolved in water.

Sulphate.—8. One litre of the decanted liquid should be acidified with Hydrochloric Acid, boiled, Barium Chloride added, filtered, and Barium Sulphate weighed. To be reported as SO_3.

Chloride.—9. 500 c.c., or suitable quantity, of the decanted liquid titrated with N 10 Silver Nitrate Solution. If the amount of Chloride present is small the liquid can be concentrated by evaporation before being titrated.

Ammonia.—10. One litre of the decanted liquid just acidified with dilute Sulphuric Acid and concentrated to 100 c.c. This, after making decidedly alkaline, to be distilled into N 10 acid and the Ammonia calculated.

(Alternative: If the liquid is not appreciably coloured, 10 c.c. to 25 c.c. may be directly "Nesslerised" with 1 c.c. of Nessler reagent.)

Lime.—11. One litre of the decanted liquid, to which solution of Ammonium Oxalate and a few drops of Ammonia have been added, to be concentrated to 100 c.c.; the Calcium Oxalate to be filtered, dried, gently ignited and weighed.

Alkalinity and Acidity.—12. One litre (or smaller quantity) of decanted liquid, if alkaline, to be titrated with N 10 or N 100 Hydrochloric Acid; if acid, with N 10 or N 100 Sodium Hydroxide, using Methyl Orange as indicator; acidity to be calculated as H_2SO_4 and alkalinity as NH_3.

PREVENTION OF GROWTH OF ORGANISMS, ALGÆ, ETC.

Before the bottles are placed in position under the gauges at the beginning of each month, 1 c.c. of an aqueous solution of $CuSO_4$ $5H_2O$ containing 15 grammes of the crystallised salt per litre should be added to each bottle.

The use of Copper Sulphate as an antiseptic involves a small correction in the determination of TOTAL DISSOLVED SOLIDS and SULPHATES. The following deductions should be made:—

(*a*) From the quantity of TOTAL DISSOLVED SOLIDS (par. 7), as determined from the above instructions, deduct 11 milligrammes for each bottle of rainfall collected.

(*b*) From the "loss on ignition in Dissolved Matter," as determined from the above instructions, deduct 1 milligramme for each bottle of rainfall collected.

(*c*) From the quantity of SO_3 (par. 8), as determined by the above instructions, deduct 5 milligrammes for each bottle of rainfall collected.

NOTES ON THE SELECTION OF CHEMICAL CHARACTERISTICS.

It should be pointed out that an examination, even approaching a complete analysis of the deposits of all gauges month by month, would be a task entirely beyond the Committee's resources. Such an analysis would involve the estimation of all elements contained in the deposits, together with their form of combination, and it would not be complete without a botanical and bacteriological study of the organisms present.

In order to devise a simple scheme of investigation, which can be uniformly carried out by any competent analyst, it is necessary to select a few characteristic items which appear likely to throw most light on the nature of the polluting matter, and which can be determined month by month in ordinary routine work for a large number of samples.

The following explanation of the items recorded, together with the reasons for their selection, may be useful for non-chemical readers of these reports.

Total Solids.—This heading comprises all the solid matter suspended either by itself or in combination with water in the atmosphere. A portion of it may be considered as a legitimate constituent of the atmosphere, as air, free from dust of one kind or another, can only be expected at extremely high altitudes. A portion of the total solids is soluble in water and is found by the evaporation of the deposited water or an aliquot portion of it. The remainder, being insoluble in water, appears mostly as a sediment in the collecting bottles after standing for some time. A small portion may remain suspended in the water, particularly after agitation.

Undissolved Matter.—The matter freely suspended in air and insoluble in the deposited water has, obviously, the first claim for examination. It consists largely of dust from the ground and carbonaceous smoke from the incomplete combustion of raw fuel. The composition of the dust varies in different districts according to the geological and surface features of the ground. It is different in town and country and depends upon the kind and state of roads and other open spaces. The portion due to mineral dust in the undissolved solids can be approximately gauged by their percentage of "ash" (this value also includes the "ash" contained in soot or smoke) obtainable upon ignition. However, before igniting the undissolved matter it is extracted with carbon bisulphide. The portion soluble in carbon bisulphide is largely composed of tarry matter, which is derived from the oily constituents of coal smoke.

It must be remembered that coal, on being burnt in a grate, is partly carbonised, yielding volatile products similar to those obtained from a gas retort. Unless the fuel-bed is so arranged that these products undergo complete combustion they will issue from the chimney along with the unconsumed sooty carbon. The tarry matter gives, therefore, an indication of the amount and character of the soot contained in the deposits. (The amount of fatty extract from vegetable or animal dust, which would be recorded under this heading, is probably negligible.)

The "loss on ignition" of the undissolved matter represents largely the carbonaceous matter, such as soot, emitted in the form of smoke. It would also represent any organic matter of vegetable or animal origin carried into the air in the form of dust. A further, but relatively small, portion consists of water of constitution from clayey matter, carbon dioxide from limestone, and the like.

Dissolved Matter.—The dissolved matter consists of that portion of the total solids which is readily soluble in water, such as chlorides, sulphates, and other salts. Free acids originally present in the atmosphere, such as sulphur dioxide or sulphuric acid, may react with the basic constituents of the undissolved matter and go into solution either in the course of, or after, deposition.

The only analytical treatment to which the dissolved solids are submitted is the estimation of the total mineral constituents contained in them by ignition. The "loss on ignition," being the difference between their original weight and the weight of "ash" obtained, represents partly combustible organic matter and partly water of constitution or volatile products of decomposition, such as carbon dioxide, ammonium salts, sulphuric or sulphurous acid, nitric acid, &c.

Apart from the above items, the sum of which represents the total solids, the separate estimation of a few constituents, already included in the total or in one of the items, is made, as they appear to throw some light upon the character of the various deposits.

Sulphates.—The sulphates present in the liquid portion are estimated and returned in terms of SO_3—i.e., sulphur trioxide or sulphuric anhydride—which represents the acid portion of all sulphates. The basic portion, such as ammonia, soda, lime, alumina, is not included in this figure. This item can be taken to represent the oxides of sulphur derived from the combustion of coal, oil, or gas containing sulphur of any kind.

Chlorides.—The chlorides are returned in terms of Cl, and do not, therefore, include the basic portion, which would probably consist of alkali or magnesia. It is probable that the greater portion of the chlorides is due to wind-borne sea-water spray.

Ammonia.—This is returned as free ammonia (NH_3), although it is probably present in most cases in the form of salts, such as sulphate or chloride. It may be derived from the carbonisation of coal in open fires and also from the decomposition or degradation of vegetable or animal nitrogenous matter.

Lime.—The estimation of lime and that of alkalinity or acidity of the deposits is optional, and was included in the analytical scheme with a view to its further extension.

It would be interesting to include tests for a great number of other items in these investigations; for instance, the estimation of the alkalies—iron, alumina—the identification and state of oxidation of the various acid and basic radicles, the separation of organic compounds, and the bacteriological examination of deposits, but, for the reasons stated above, the Committee think it desirable for the present to restrict the experimental work as far as possible, and to obtain the maximum results from the information thus gathered.

RESULTS OBTAINED IN THE YEAR FROM APRIL, 1915, TO MARCH, 1916.

CLASSIFICATION ADOPTED.

In the first Report of the Committee the numerical results for each element of deposit were classified under certain groups, A, B, C, and D, chosen for the purpose of permitting easy and effective comparison between the stations.

As in the present Report the same classification is adhered to, the preliminary explanatory matter showing the basis of the above classification is here again repeated for convenience of reference:—

Class A includes the stations which have less than 1 unit of deposit per square kilometre.

Class B, the stations which have between 1 and 3 units of deposit per square kilometre.

Class C, the stations which have between 3 and 5 units of deposit per square kilometre.

Class D, the stations which have 5 or more units of deposit per square kilometre.

The unit has been adjusted to suit each separate element, but the proportional division has been kept the same throughout. Thus for "total solids" the unit is 5 tons and the law of classification is—

Class A, less than 5 tons per square kilometre per month.

Class B, from 5 to 15 tons per square kilometre per month.

Class C, from 15 to 25 tons per square kilometre per month.

Class D, from 25 or more tons per square kilometre per month.

It will be understood that the figure 5 belongs to Class B, not Class A, and so on.

The units and limits in the several cases are as follows:—

Insoluble Matter.

Unit.		Limits.			
—	Tons per K^2 per month.	A Less than	B	C	D Over
Tar	0·05	0·05	0·05 to 0·15	0·15 to 0·25	0·25
Carbonaceous other than tar	1	1	1 to 3	3 to 5	5
Ash	2	2	2 to 6	6 to 10	10

Soluble Matter.

Loss on ignition	0·75	0·75	0·75 to 2·25	2·25 to 3·75	3·75
Ash	1·5	1·5	1·5 to 4·5	4·5 to 7·5	7·5
Total solids	5	5	5 to 15	15 to 25	25
Sulphates ...	1	1	1 to 3	3 to 5	5
Chlorine ...	0·3	0·3	0·3 to 0·9	0·9 to 1·5	1·5
Ammonia ...	0·05	0·05	0·05 to 0·15	0·15 to 0·25	0·25

Note.—Although sulphates in 1914–15 were returned as SO_4 and in 1915–16 as SO_3, the unit for classification has not been altered; but for the purpose of comparing the two years the sulphates in 1914–15 were re-classified as SO_3.

TABLES INCLUDED IN REPORT.

Table I. shows the monthly deposit for two selected stations, Oldham and Malvern, chosen as showing respectively the greatest and least amount of total solids deposited.

Tables II. and III. show respectively a comparison of monthly means for all stations for the half-years April–September, 1914–15 and 1915–16, and October–March, 1914–15 and 1915–16.

Table IV. compares the monthly means for summer and winter months of the year 1915–16.

Tables V. and VI. give the classification of the elements of pollution under Groups A, B, C, and D for the same periods as Tables II. and III. and based upon the monthly means as given in Tables II. and III.

Tables VII. and VIII. give the totals of each group, A, B, C, and D, for each element of pollution for all stations taken. These tables are prepared from Tables V. and VI. and cover the same periods.

Table IX. shows the average deposit of each element of pollution for each month for a certain group of 23 stations which provided practically continuous observations over a whole year from October, 1914, to September, 1915. This also shows the amount of each deposit per 100 mm. of rainfall.

Table X. is similar to Table IX., but includes the eight London stations only and is for the year from April, 1915, to March, 1916.

Owing to the war and the consequent need for economy, the Committee considered it advisable to omit from this Report most of the tables giving the actual monthly deposit for the different stations. Two stations are, however, given in Table I. selected as having the greatest and least deposit, and it is hoped that the other tables given will prove adequate for the purpose of this Report. All monthly returns have been published already *in extenso* in THE LANCET from time to time, and the figures are thus available for any who desire to refer to them.

For the purpose of such reference it may here be stated that the monthly returns and dates of publication were as follows:—

Return for		
April, 1915.	Published in THE LANCET of	Aug. 21st, 1915.
May, ,,	,, ,,	Oct. 9th, ,,
June, ,,	,, ,,	Nov. 6th, ,,
July, ,,	,, ,,	Jan. 29th, 1916.
Aug., ,,	,, ,,	Feb. 19th, ,,
Sept., ,,	,, ,,	Mch. 25th, ,,
Oct., ,,	,, ,,	Apl. 15th, ,,
Nov. and Dec., 1915, and Jan., 1916.	,, ,,	June 3rd, ,,
Feb. and Mch., 1916.	,, ,,	July 15th, ,,

It will be observed on referring to Tables II., III., and IV. that the number of months used to obtain the figure representing "monthly mean" deposit is given for each station. It must, however, here be pointed out that when this number falls far short of six for the half-year broad inferences cannot be drawn; taking, for example, an extreme case where only one month's record is available for the half-year it may be that this month is not fairly representative of the period considered.

DISCUSSION OF RESULTS.

We may examine the results from several points of view, and it may be well to summarise here the aspects towards which we shall direct our attention. These are—

(1) Comparing the year 1915–16 with 1914–15 is there any indication of an improved state of the atmosphere or the reverse?

(2) What are the stations showing the greatest and least amount of deposit?

(3) How is the amount of impurity deposited affected by the seasons?

(4) Is there any indication of a relation existing between e.g. rainfall and total deposit or between the different elements of pollution?

To assist in making a more general use of the tables of deposit the following list of equivalents may prove of value

One metric ton per square kilometre is approximately equivalent to—

9 lbs. per acre.
2·56 English tons per square mile.
One gramme per square metre.
1 1000 millimetre depth of rainfall.

Tables II. and III.—As these tables are for comparison of the first two years of records they include only such stations as were operating in both 1914–15 and 1915–16.

It will be found, therefore, that a greater number of stations are included in Table IV., which refers only to stations at work in 1915–16.

Considering first the six summer months, April to September inclusive, and comparing the two years on the basis of total solids deposited, the stations fall into three groups: (1) Those in which the total deposit in 1915–16 was greater than in 1914–15; (2) those in which it was less; and (3) the stations which showed no alteration. These groups are given below, and for this purpose stations which do not show a greater alteration in total solids than 0·3 metric ton per square kilometre have been placed in Group (3).

Total Solids Deposited in the Summer Months of 1915–16 Compared with 1914–15.

Deposit.		
Increased in 1915–16.	Diminished.	Unchanged.
Liverpool.	Birmingham, Central.	Kingston-upon-Hull.
London:—	Bolton.	London, Victoria Park.
Meteorological Office.	Malvern.	Finsbury Park.
Embankment Gardens.	Sheffield, Attercliffe.	Newcastle-on-Tyne.
Ravenscourt Park.	York.	Exeter.
Southwark Park.		
Wandsworth Common.		
Golden Lane.		
Manchester:—		
Cheadle.		
Davyhulme.		
Fallowfield.		
School of Technology.		
Whitefield.		
Oldham.		
Sheffield:—		
Hillsborough Park.		
Meersbrook Park.		
Weston Park.		
Greenock.		
Leith.		

It is very noticeable here that in the great majority of stations there has been a heavier deposit in the summer of 1915–16 than in 1914–15. This is too uniformly true to be a coincidence, and suggests a common cause.

A similar method has been applied to the six winter months and the two years compared on the basis of total solids deposited, with the results given below:—

Total Solids Deposited in the Winter Months of 1915–16 Compared with 1914–15.

Deposit.		
Increased in 1915–16.	Diminished.	Unchanged.
Birmingham, Aston.	Bolton.	Liverpool.
Birmingham, S.W.	Exeter.	London, Golden-lane.
London:—	Kingston-upon-Hull	Malvern.
Meteorological Office.	Wandsworth Common.	Manchester, Bowdon.
Embankment Gardens.	Manchester:—	
Finsbury Park.	Davyhulme.	
Ravenscourt Park.	Moss Side.	
Southwark Park.	Queen's Park.	
Victoria Park.	Oldham.	
Manchester:—	York.	
Ancoats.	Glasgow:—	
Philip's Park.	Alexandra Park.	
School of Technology.	Blythswood-square.	
Whitefield.	Ruchill Park.	
Newcastle-on-Tyne.	Tollcross Park.	
Coatbridge.	Victoria Park.	
Glasgow:—		
Bellahouston Park.		
Botanic Gardens.		
Richmond Park.		
Southside Park.		
Greenock.		
Leith.		

In this case there is again a preponderance of stations in which the deposit has increased, but it is not so marked as for the summer months.

If we take the mean monthly deposit in London—i.e., the average of all London stations—this was, for the summer of 1914–15, 10·91 metric tons per square kilometre and for the winter 11·41, whereas for the corresponding periods of 1915–16 it was 13·41 and 15·97 respectively, showing a marked increase in both seasons. The mean monthly deposit for the whole year in London was in 1914–15 11·16 tons per square kilometre and in 1915–16 14·69, an increase of over 30 per cent.

It is to be noted, however, that for the summer comparison in this case there was only one month available in 1914–15 for five out of seven of the London stations.

In Tables II. and III. the summer and winter deposits for each station are compared for the years 1914–15 and 1915–16, and we have seen that the latter year shows a majority of stations with increased deposit. In Tables VII. and VIII. we go a step farther by taking each element of pollution and finding the total of stations giving deposits grouping under Class A, B, C, or D. This is derived from Tables V. and VI., and like these is based on the mean monthly deposits for summer or winter. In the following table we have again reduced Tables VII. and VIII. to a comparison of the number of A's and B's added together and the C's and D's.

Comparison of 1914–15 with 1915–16.

—			April to Sept. (12 stations).		Oct. to March (38 stations).	
			A & B.	C & D.	A & B.	C & D.
Total solids	1914–1915		9	3	20	18
	1915–1916		10	2	16	22
Tar	1914–1915	Insoluble.	10	2	34	4
	1915–1916	Insoluble.	9	3	21	17
Carbonaceous	1914–1915	Insoluble.	8	4	25	13
	1915–1916	Insoluble.	8	4	30	8
Ash	1914–1915	Insoluble.	8	4	28	10
	1915–1916	Insoluble.	8	4	27	11
Loss on ignition	1914–1915	Soluble.	11	1	25	13
	1915–1916	Soluble.	10	2	14	24
Ash	1914–1915	Soluble.	10	2	13	25
	1915–1916	Soluble.	11	1	10	28
Sulphates	1914–1915		12	0	24	14
	1915–1916		12	0	26	12
Chlorine	1914–1915		12	0	26	12
	1915–1916		11	1	22	16
Ammonia	1914–1915		9	3	26	12
	1915–1916		10	2	25	13

We have therefore now obtained a means of direct comparison between the quantities deposited in the years under consideration.

A greater number under A + B in any period indicates a smaller deposit, a greater number under C + D a greater deposit, and we need only examine, say, the C + D column, since the A + B column is simply the complement of the C + D.

Considering now the C + D column and comparing the summer of 1914–15 with that of 1915–16, we note that tar, soluble loss on ignition, and chlorine showed a slightly greater deposit in 1915–16 than in 1914–15. Insoluble carbonaceous matter other than tar, insoluble ash, and sulphates show no alteration, while total solids, soluble ash, and ammonia were in greater quantity in the year 1914–15.

It should, however, be mentioned that the number of stations available for the summer comparison was only 12, hence too much weight must not be put on the above conclusions.

Looking at the columns comparing the winter months for the two years, we have a more reliable set of figures, as these are obtained from 38 stations. We find here clear evidence of increase in the amount of atmospheric pollution; total solids, tar, insoluble ash, soluble loss on ignition and ash, chlorine, and ammonia have all increased in quantity in 1915–16. The only evidence of reduced deposits in 1915–16 is in the case of insoluble carbonaceous matter other than tar and sulphates.

In the following table the stations giving the highest recorded mean monthly deposit as well as the lowest during the whole year April, 1915, to March, 1916, have been selected:—

Mean Monthly Deposit, 1915–16, in tons per square kilometre.

—	Highest.		Lowest.	
Total solids	Oldham	29·35	Malvern	1·81
Tar	Manchester—Ancoats Hosp.	23·94	Birmingham, S.W.	6·82
	Glasgow—Bellahouston Park	0·41	Malvern	0·005
	London—Embankment Gardens	0·38	Manchester—Bowdon	0·01
Carbonaceous other than tar	Oldham	5·28	Malvern	0·17
	London—Embankment Gardens	4·64	Manchester—Bowdon	0·46
Insoluble ash	Oldham	16·48	Malvern	0·27
	Manchester—Ancoats Hosp.	11·09	Manchester—Bowdon	1·69
Loss on ignition of soluble matter	Glasgow—Alexandra Park	4·89	Malvern	0·49
	Victoria Park	3·68	B'ham., S.W.	0·63
Soluble ash	London—Embankment Gardens	7·20	Malvern	0·88
	Manchester—Bowdon	6·56	York	2·26
Sulphates (SO_3)	Glasgow—Alexandra Park	3·52	Malvern	0·40
	Blythswood Square	3·45	York	1·19
			B'ham., S.W.	1·20
Chlorine	Manchester—Moss Side	1·54	Birmingham, S.W.	0·18
	Sheffield—Attercliffe	1·38	Malvern	0·19
Ammonia	Glasgow—Victoria Park	0·24	Malvern	0·02
	Alexandra Park	0·21	Exeter	0·03
	London—Golden Lane	0·21	Manchester—Queen's Park	0·03

It will be seen from this table that there is a great variation in the amount of deposited matter, the maximum being ten or more times the minimum. It must, however, be borne in mind that Malvern station, which has the minimum deposit in every case except one, is a country station, situated at Malvern Wells, whereas the maximum deposits were invariably in cities. Although it does not appear on this table, it is curious to note that the nine Glasgow stations provide examples, in the case of nearly all constituents, of deposits approaching the maximum and also the minimum. This will be seen on examining Table IV., which gives mean monthly deposits for the summer and winter months separately.

SEASONAL VARIATIONS.

In order to examine the seasonal incidence of the various elements of deposit the following methods have been used. In Table IV., as mentioned above, the six summer months are compared with the six winter months on the basis of mean monthly deposit. This table throws into relief the broad distinction between summer and winter deposits.

TABLE I.—*Monthly Deposit at the Two Selected Stations, Oldham and Malvern.*

—	Station.	Rainfall in millimetres.	Insoluble matter.			Soluble matter.			Included in soluble matter.		
			Tar.	Carbonaceous other than tar.	Ash.	Loss on ignition.	Ash.	Total solids.	Sulphate as (SO_3).	Chlorine (Cl).	Ammonia (NH_3).
1915.											
April	Oldham.	43	0·26	4·70	17·01	2·89	6·47	31·33	3·05	0·85	0·11
	Malvern.	17	0·01	0·12	0·14	0·27	0·53	1·07	0·21	0·11	0·01
May	Oldham.	48	0·43	7·03	36·21	1·36	4·07	49·10	2·16	0·62	0·14
	Malvern.	77	—	0·12	0·37	0·31	0·56	1·36	0·26	0·11	0·02
June	Oldham.	70	0·29	6·15	20·80	1·69	5·63	34·60	2·12	0·65	0·17
	Malvern.	36	—	0·30	0·47	0·41	0·69	1·87	0·34	0·10	0·01
July	Oldham.	120	0·18	4·41	9·75	2·87	7·66	24·90	3·17	0·81	0·16
	Malvern.	83	—	0·33	0·37	0·79	0·96	2·47	0·47	0·35	0·04
August* ...	Oldham.	119	0·14	2·69	3·95	0·95	6·21	13·94	2·13	0·68	0·12
September	Oldham.	17	0·10	3·98	11·37	0·90	2·36	18·71	1·10	0·35	0·08
October† ...	Oldham.	42	0·22	7·97	16·24	3·04	5·40	32·87	2·82	1·09	0·23
1916.											
January ...	Malvern.	26	—	0·05	0·10	0·41	1·67	2·23	0·61	0·28	—
February ...	Malvern.	85	—	0·08	0·20	0·52	0·82	1·62	0·41	0·25	—
March ...	Malvern.	44	0 01	0·12	0·23	0·72	0·95	2·03	0·53	0·14	0·04

* Malvern sent no returns from August to December, 1915, inclusive.
† Oldham discontinued observations after October.

To ascertain, however, if there was any regular change from month to month or any obvious relation between the different elements of the deposit, it is clear that one station alone would be unlikely to provide the necessary indication of such relation, should there be any.

It was therefore decided to compare the deposit for each month on the basis of an average for all stations for each particular month. There was, however, the difficulty that the group of stations observing altered during the year owing to new stations commencing, or existing ones suspending, work, and if not allowed for this would obscure the true seasonal relation, should there be one.

It was found that to select only those stations which were in operation from April, 1915, to March, 1916, would leave a very small group, owing to the reduction of stations occurring about the autumn of 1915 owing to the war. If, however, the year from October, 1914, to September, 1915, were taken, it provided a group of about 22 stations operating through the whole period, and as this period therefore promised more useful information as to seasonal incidence and relation between the various elements of pollution it was chosen for the purpose.

This variation in the number of observing stations is one of the difficulties which the Committee has had to cope with. The Committee believes that if the authorities which are coöperating realised this fact they would make a greater effort to maintain their observing stations, at least until the completion of current years on March 31st.

It will be convenient now to consider each of the constituents, or elements, of pollution separately, and for this purpose reference must be made to Table IX. and the graphs in Fig. I.

From this table the following list has been prepared showing the months of highest and lowest deposit for each element of pollution, together with the rainfall for comparison. It must be kept in mind that Table IX. and the graphs in Fig. I. are prepared from the averages of the monthly deposits of all stations included, the number being given in the table, so that, except so far as weather variations between the different stations may obscure the result, a fair idea is given of the seasonal incidence of the different elements of pollution and their relation to each other.

Table showing the Months of Highest and Lowest Deposit for each Element of Pollution, October, 1914, to September, 1915. Prepared from Average of 23 Stations.

—		Highest	Second highest.	Lowest.	Second lowest.
Rainfall...		Dec.	July	March April June	—
Tar...	Insoluble	,,	,,	Sept.	Aug.
Carbonaceous	Insoluble	July	Dec.	,,	April
Ash...	Insoluble	June	,,	Aug.	Nov.
Loss on ignition	Soluble	Dec.	Jan.	June	March
Ash...	Soluble	,,	Feb.	,,	April
Total solids...		,,	May	Aug.	Sept.
SO_3...		,,	Jan.	June	April
Cl		,,	Feb.	,,	Sept.
NH_3		Jan.	Nov.	March	,,

It will be seen from this that loss on ignition and ash of the soluble matter, as well as sulphates, make their highest deposit in December, their second highest in January or February, and their lowest in March, April, or June, thus corresponding closely with the months of greatest and least rainfall. It is clear, therefore, that there is some relation between the deposit of soluble matter and rainfall; this will be even more apparent on examining the curves and will be referred to later.

Tar and total solids have their greatest deposit in December, and least in September and August.

The other remaining constituents do not lend themselves to any grouping, but it may be noted that, there is a general tendency for maximum deposits to occur in the winter months and minimum deposits in summer. The most notable instance of a maximum deposit in the summer months is that of insoluble ash, and this is more remarkable than the mere examination of the above list would indicate. Referring to the graph, Fig. I., it will be seen how evident is the increase of this deposit in the fine weather. Doubtless the favourable conditions for the production of dust from roads and other sources accounted for this.

In last year's Report it was stated that ammonia showed itself as a summer product; this conclusion does not hold good for the period at present under consideration, as it appears that the greatest deposits occurred in January and November, the lowest in March and September. Whether the conditions have altered in any way owing to the restrictions on the use of raw coal as a fuel, which are coming more and more into force, it is not possible to say at present; but it is of interest to remember that we are now really comparing the winter of 1914 with the summer of 1915, for the reasons already indicated. It may be that when fuel consumption has attained a "steady state" the summer preponderance of ammonia will again appear. Or again a comparison of, e.g., the summer of 1915 with the winter of 1916 may give an indication of the cause, since if the diminishing use of raw coal is having an effect it should be brought out by such comparison, as in that case it would tend to increase the summer preponderance of ammonia over the *following* winter. It is necessary in this connexion to keep in mind the point already referred to in describing Mr. Tanhard's experiments under "Analyses," which deals with the variation in the amount of ammonia present arising from the growth of organisms in the water collected.

TABLE II.—*Comparison of Monthly Means for all Stations for the Six Months, April to September, 1914 and 1915.*

—		April to September. Rainfall in millimetres.	Metric tons per square kilometre. Insoluble matter. Tar.	Insoluble matter. Carbonaceous other than tar.	Insoluble matter. Ash.	Soluble matter. Loss on ignition	Soluble matter. Ash.	Total solids.	Included in soluble matter. Sulphate as (SO_3).	Included in soluble matter. Chlorine (Cl).	Included in soluble matter. Ammonia (NH_3).	No. of months used for average.
Birmingham Central ...	1914	53	0·16	3·87	11·18	1·45	4·85	21·51	1·96	0·81	0·45	5
	1915	79	0·23	2·08	6·29	0·80	2·30	11·70	1·00	0·40	0·06	1
Bolton	1914	117	0·12	2·37	6·15	5·00	6·47	20·05	3·07	1·19	0·07	3
	1915	84	0·06	2·55	4·56	2·91	6·13	16·22	3·13	0·96	0·06	5
Exeter	1914	53	0·05	1·78	3·33	0·96	1·71	7·82	0·59	0·25	0·01	6
	1915	46	0·02	1·30	3·07	1·01	2·23	7·63	0·95	0·22	0·02	6
Kingston-upon-Hull ...	1914	42	0·10	3·38	4·13	1·49	3·19	12·29	1·39	0·40	0·03	6
	1915	46	0·11	3·13	3·83	2·18	3·31	12·56	1·65	0·35	0·04	6
Liverpool	1914	60	0·63	2·59	8·19	3·19	4·23	18·83	2·33	0·75	0·21	6
	1915	63	0·19	4·22	8·91	1·93	4·36	19·62	2·39	0·59	0·15	6
London:—												
Meteorological Offices	1914	60	0·05	1·71	3·56	1·71	2·39	9·43	1·22	0·61	0·09	6
	1915	62	0·09	0·72	2·84	2·82	3·70	10·08	1·65	0·72	0·08	6
Embankment Gardens	1914	26	0·38	5·51	7·04	0·95	4·70	18·58	1·11	0·50	0·03	5
	1915	55	0·41	5·04	8·38	2·79	6·89	23·50	2·74	1·21	0·13	6
Finsbury Park	1914	30	0·11	2·87	6·15	1·80	3·60	14·53	1·81	0·40	0·07	1
	1915	48	0·13	1·85	6·16	0·84	2·60	11·59	1·20	0·34	0·03	6
Ravenscourt Park ...	1914	22	0·01	0·55	1·47	0·26	1·10	3·39	0·36	0·30	0·03	1
	1915	52	0·07	1·42	4·51	1·05	2·95	9·99	1·46	0·30	0·09	6
Southwark Park	1914	19	0·05	3·27	6·73	0·32	3·26	13·63	1·35	0·37	0·05	1
	1915	56	0·12	2·56	6·85	1·93	5·24	16·71	2·98	0·53	0·11	6
Wandsworth Common	1914	10	0·02	0·54	1·31	1·25	2·76	5·88	1·25	0·41	0·01	1
	1915	39	0·05	0·90	3·48	0·72	4·69	9·83	—*	—*	—*	6
Victoria Park...	1914	30	0·05	0·99	2·29	2·49	6·61	12·44	3·00	0·73	0·04	1
	1915	50	0·07	1·51	4·62	1·94	4·18	12·32	2·17	0·50	0·10	6
Golden Lane	1914	31	0·04	2·17	3·52	1·20	2·51	9·42	1·33	0·45	0·11	6
	1915	64	0·06	3·06	4·70	1·74	3·65	13·22	2·05	0·64	0·18	6
Malvern	1914	46	0·01	0·24	0·40	0·57	0·97	2·22	0·40	0·19	0·03	6
	1915	53	—	0·22	0·34	0·44	0·68	1·69	0·32	0·17	0·02	4
Manchester:—												
Cheadle	1914	72	0·10	2·04	2·00	1·50	3·18	8·76	1·47	0·74	0·06	2
	1915	60	0·14	1·99	3·37	1·33	2·32	9·16	1·39	0·72	0·09	5
Davyhulme	1914	64	0·03	0·99	2·00	1·15	2·78	6·94	1·57	0·62	0·08	2
	1915	54	0·02	0·99	3·37	1·26	4·03	9·67	2·32	0·46	0·08	6
Fallowfield	1914	78	0·04	1·05	2·06	0·86	2·54	6·53	1·45	0·52	0·05	2
	1915	54	0·04	1·16	3·30	1·08	4·04	9·62	1·99	0·35	0·04	6
School of Technology...	1914	86	0·11	3·68	7·26	1·90	5·47	18·43	2·66	1·25	0·10	3
	1915	60	0·16	3·04	9·71	1·50	4·85	19·26	2·39	0·63	0·08	6
Whitefield	1914	89	0·04	1·44	3·29	1·35	4·73	10·85	2·20	0·77	0·06	2
	1915	60	0·03	1·74	4·46	1·65	4·16	12·04	2·53	0·48	0·06	5
Newcastle-upon-Tyne ...	1914	48	0·14	3·55	6·57	1·12	2·26	13·64	1·22	0·28	0·10	6
	1915	24	0·13	2·75	6·87	1·08	2·79	13·63	1·38	0·28	0·09	6
Oldham...	1914	67	0·22	4·16	10·58	1·70	4·33	20·57	1·12	0·64	0·13	2
	1915	69	0·23	4·83	16·51	1·78	5·40	28·76	2·29	0·66	0·13	6
Sheffield—												
Attercliffe	1914	41	0·51	3·37	10·90	1·52	5·82	22·12	2·32	1·16	0·06	3
	1915	28	0·11	3·16	7·27	2·00	3·55	16·10	1·25	1·38	0·04	3
Hillsborough Park ...	1914	42	0·31	0·43	2·64	0·72	2·81	6·91	1·05	0·80	0·05	3
	1915	35	0·06	1·45	4·93	0·86	4·13	11·43	1·70	0·60	0·04	3
Meersbrook Park... ...	1914	49	0·32	0·10	2·15	0·93	2·54	6·72	1·05	0·67	0·05	3
	1915	35	0·07	1·39	4·43	0·71	3·68	10·28	1·75	0·56	0·04	3
Weston Park...	1914	44	0·48	0·73	3·60	1·21	3·05	9·06	1·14	0·67	0·06	3
	1915	35	0·05	1·51	4·81	1·13	3·35	10·85	1·65	0·66	0·04	3
York	1914	47	0·08	1·56	3·07	0·98	2·12	7·83	0·84	0·38	0·30	6
	1915	26	0·06	1·05	2·78	0·81	1·38	6·09	0·64	0·23	0·06	6
Greenock	1914	65	0·04	1·74	3·64	1·37	2·13	8·92	0·88	0·30	0·06	6
	1915	54	0·05	2·66	5·00	1·60	2·85	12·17	1·38	0·41	0·12	6
Leith	1914	34	0·06	1·19	2·73	0·95	1·31	6·25	0·69	0·18	0·07	6
	1915	56	0·05	1·26	3·34	2·08	2·63	9·36	1·13	0·23	0·11	6

* Results unreliable.

TABLE III.—*Comparison of Monthly Means for all Stations for the Six Months; October to March, 1914–15 and 1915–16.*

—	—	Rainfall in millimetres.	Metric tons per square kilometre.									No. of months used for average.
			Insoluble matter.			Soluble matter.		Total solids.	Included in soluble matter.			
			Tar.	Carbonaceous other than tar.	Ash.	Loss on ignition.	Ash.		Sulphate as (SO_3).	Chlorine (Cl).	Ammonia (NH_3).	
Birmingham, Aston ...	1914-15	73	0·07	1·93	4·73	1·14	4·19	12·07	1·92	0·46	0·04	6
	1915-16	44	0·08	2·51	6·71	1·04	4·22	14·56	2·04	0·30	0·07	1
Birmingham, S.W.	1914-15	84	0·04	0·77	1·99	0·63	2·60	6·04	0·97	0·42	0·02	6
	1915-16	49	0·04	1·00	3·06	0·83	3·56	8·49	1·70	0·24	0·04	1
Bolton	1914-15	121	0·11	1·99	6·41	4·49	9·64	22·63	4·62	2·02	0·10	6
	1915-16	89	0·08	2·78	6·31	2·52	6·06	17·74	2·73	1·71	0·08	2
Exeter	1914-15	88	0·04	1·54	2·86	1·72	3·79	9·94	1·43	0·86	0·03	6
	1915-16	103	0·02	1·43	2·12	1·57	3·60	8·74	1·67	0·77	0·03	6
Kingston-upon-Hull ...	1914-15	64	0·07	2·53	4·57	2·61	5·06	14·84	2·45	0·73	0·06	6
	1915-16	55	0·14	2·66	3·62	3·00	4·83	14·25	2·34	0·79	0·04	4
Leicester	1914-15*	—	—	—	—	—	—	—	—	—	—	—
	1915-16	82	0·22	3·89	4·96	3·52	4·72	17·31	2·31	0·58	0·16	5
Liverpool	1914-15	75	0·29	2·29	8·34	3·15	4·52	18·60	2·76	0·99	0·57	6
	1915-16	81	0·23	2·88	6·39	3·49	5·68	18·67	2·82	1·17	0·22	3
London :—												
Meteorological Office ...	1914-15	64	0·14	0·85	4·38	3·91	4·98	14·26	2·20	0·92	0·06	6
	1915-16	69	0·13	2·43	4·97	2·70	6·75	16·99	2·46	1·06	0·09	6
Embankment Gardens	1914-15	66	0·23	3·39	7·31	1·84	7·43	20·21	2·90	1·30	0·07	6
	1915-16	63	0·35	4·05	7·53	2·58	7·67	22·17	3·58	1·22	0·09	4
Finsbury Park	1914-15	65	0·21	1·75	4·26	1·45	4·70	12·34	1·80	0·47	0·05	6
	1915-16	71	0·20	1·88	5·93	1·36	4·64	14·01	2·01	0·56	0·05	6
Ravenscourt Park ...	1914-15	64	0·05	1·06	2·85	0·99	4·32	9·28	1·70	0·44	0·06	6
	1915-16	71	0·10	2·04	4·57	1·68	5·47	13·86	2·78	0·45	0·09	5
Southwark Park	1914-15	75	0·09	3·27	6·27	1·58	6·60	17·81	2·81	0·70	0·09	6
	1915-16	69	0·16	3·64	7·32	2·65	7·08	20·85	2·98	0·76	0·10	6
Wandsworth Common	1914-15	56	0·03	0·88	2·51	1·41	5·16	9·99	2·44	0·53	0·04	6
	1915-16	59	0·07	1·05	3·01	0·91	3·37	8·40	1·57	0·57	0·03	5
Victoria Park	1914-15	66	0·05	1·27	2·74	1·66	5·34	11·07	2·52	0·54	0·05	6
	1915-16	57	0·05	1·11	4·45	2·42	7·05	15·07	3·52	0·61	0·06	6
Golden Lane	1914-15	73	0·08	3·20	5·06	2·58	5·46	16·28	3·02	0·88	0·14	6
	1915-16	74	0·08	3·39	4·85	3·17	4·89	16·37	3·03	0·88	0·24	6
Malvern	1914-15	53	0·00	0·13	0·25	0·63	1·03	2·05	0·44	0·29	0·01	6
	1915-16	52	0·00	0·08	0·18	0·55	1·15	1·96	0·52	0·22	0·01	3
Manchester :—												
Ancoats	1914-15	78	0·11	4·47	11·57	1·95	8·69	26·79	4·19	1·13	0·08	3
	1915-16	27	0·11	5·60	11·91	2·48	8·64	28·74	4·03	1·13	0·10	1
Bowdon	1914-15	69	0·01	0·49	1·78	0·66	2·74	5·69	1·22	0·55	0·05	3
	1915-16	34	0·01	0·48	2·14	0·67	2·44	5·74	1·14	0·43	0·05	1
Davyhulme	1914-15	70	0·02	1·05	4·08	0·96	5·11	11·23	2·41	0·76	0·09	5
	1915-16	38	0·03	0·98	4·13	1·79	3·64	10·57	1·34	0·83	0·11	1
Moss Side	1914-15	75	0·14	2·01	5·86	1·44	6·15	15·60	2·77	1·04	0·09	3
	1915-16	38	0·12	1·90	6·25	1·44	5·42	15·13	2·61	1·08	0·08	1
Philip's Park	1914-15	71	0·11	3·06	7·74	2·12	7·33	20·35	3·39	1·39	0·05	3
	1915-16	30	0·06	3·42	9·74	1·84	7·21	22·27	2·12	1·10	0·06	1
Queen's Park	1914-15	74	0·08	1·86	7·38	1·24	7·15	17·71	3·37	1·10	0·04	3
	1915-16	55	—	—	—	—	—	16·78	—	—	—	4
School of Technology ...	1914-15	77	0·12	3·33	6·71	1·39	6·65	17·21	2·72	1·08	0·07	6
	1915-16	60	—	—	—	—	—	22·95	—	—	—	4
Whitefield	1914-15	87	0·04	1·46	5·41	1·47	6·92	13·29	3·24	1·25	0·41	5
	1915-16	36	0·06	1·61	4·95	2·29	4·80	13·71	1·90	1·03	0·05	1
Newcastle-on-Tyne	1914-15	63	0·13	3·99	6·25	2·20	4·92	17·46	2·32	0·68	0·20	6
	1915-16	69	0·28	4·46	7·73	2·39	5·16	20·03	2·53	0·78	0·17	6
Oldham	1914-15	94	0·37	7·09	16·21	3·00	8·03	34·70	3·17	0·97	0·45	6
	1915-16	42	0·22	7·97	16·24	3·04	5·40	32·87	2·82	1·09	0·23	1
York	1914-15	62	0·11	1·56	3·46	1·59	3·42	10·25	1·67	0·69	0·45	6
	1915-16	49	0·15	1·38	2·49	2·60	3·14	9·76	1·75	0·64	0·09	6
Coatbridge	1914-15	70	0·09	1·55	3·40	0·91	1·94	7·89	0·95	0·27	0·08	3
	1915-16	61	0·08	1·65	3·65	1·51	3·64	10·53	1·63	0·57	0·12	6
Glasgow :—												
Alexandra Park	1914-15	54	0·05	3·76	4·00	6·05	9·65	23·51	5·97	0·54	0·26	3
	1915-16	77	0·26	1·89	2·27	6·09	8·10	18·62	3·70	1·05	0·20	5
Bellahouston Park ...	1914-15	49	—	0·91	1·86	2·43	2·22	7·42	1·21	0·33	0·15	3
	1915-16	89	0·21	1·09	1·88	4·60	5·76	13·55	3·34	1·04	0·09	5
Blythswood Square ...	1914-15	67	0·02	5·60	4·22	4·53	7·25	21·62	3·87	0·35	0·29	3
	1915-16	90	0·31	2·42	3·28	4·69	7·38	18·08	4·45	0·88	0·19	6
Botanic Gardens	1914-15	66	0·06	1·68	3·41	4·09	5·84	15·08	3·26	0·31	0·13	3
	1915-16	101	0·29	1·96	3·12	6·36	8·20	19·93	5·16	1·26	0·16	5
Richmond Park	1914-15	69	0·03	1·53	3·30	5·36	4·36	14·59	3·21	0·28	0·12	3
	1915-16	94	0·32	1·60	3·03	5·57	6·87	17·38	4·73	0·89	0·25	5
Ruchill Park	1914-15	71	0·06	3·73	3·90	1·84	5·95	15·48	3·16	0·39	0·11	3
	1915-16	99	0·23	1·41	2·38	4·60	6·52	15·15	2·94	0·81	0·15	5
South Side Park	1914-15	62	0·03	2·56	2·26	1·25	2·49	8·58	1·72	0·23	0·20	3
	1915-16	95	0·22	1·37	2·24	4·07	5·61	13·52	3·90	0·85	0·14	5
Tollcross Park	1914-15	62	0·01	3·08	3·67	4·72	8·78	20·25	3·39	0·37	0·11	3
	1915-16	91	0·26	1·58	2·77	5·00	7·01	16·63	4·25	0·86	0·15	5
Victoria Park...	1914-15	71	0·04	3·65	2·31	6·05	5·61	17·66	3·93	0·37	0·37	3
	1915-16	95	0·41	1·24	1·96	5·48	6·89	15·99	4·03	0·94	0·30	5
Greenock	1914-15	137	0·07	2·27	4·06	2·18	4·39	12·17	2·05	0·91	0·18	5
	1915-16	99	0·14	2·30	3·95	2·25	4·78	13·44	2·12	1·19	0·19	6
Leith	1914-15	38	0·06	1·35	3·66	1·73	2·64	9·44	1·19	0·48	0·17	5
	1915-16	50	0·06	1·16	3·12	2·27	3·32	9·93	1·67	0·58	0·18	5

* Not working.

TABLE IV.—*Comparison of Monthly Means for all Stations for the Six Months April to September, 1915, and the Six Months October to March, 1915-16—i.e., Summer and Winter Months.*

—	—	Rainfall in millimetres.	Metric tons per square kilometre.									No. of months used for average.
			Insoluble matter.			Soluble matter.			Included in soluble matter.			
			Tar.	Carbonaceous other than tar.	Ash.	Loss on ignition.	Ash.	Total solids.	Sulphate as (SO_3).	Chlorine (Cl).	Ammonia (NH_3).	
Birmingham, Aston ...	Apl.-Sep.	57	0·10	1·77	6·61	0·90	3·52	12·90	1·63	0·24	0·03	5
	Oct.-Mch.	44	0·08	2·51	6·71	1·04	4·22	14·56	2·04	0·30	0·07	1
Birmingham, S.W.	Apl.-Sep.	52	0·04	1·01	2·48	0·60	2·42	6·54	1·11	0·17	0·04	6
	Oct.-Mch.	49	0·04	1·00	3·06	0·83	3·56	8·49	1·70	0·24	0·04	1
Bolton	Apl.-Sep.	84	0·06	2·55	4·56	2·91	6·13	16·22	3·13	0·96	0·06	5
	Oct.-Mch.	89	0·08	2·78	6·31	2·52	6·06	17·74	2·73	1·71	0·08	2
Exeter	Apl.-Sep.	46	0·02	1·30	3·07	1·01	2·23	7·63	0·95	0·22	0·02	6
	Oct.-Mch.	103	0·02	1·43	2·12	1·57	3·60	8·74	1·67	0·77	0·03	6
Kingston-upon-Hull ...	Apl.-Sep.	46	0·11	3·13	3·83	2·18	3·31	12·56	1·65	0·35	0·04	6
	Oct.-Mch.	55	0·14	2·66	3·62	3·00	4·83	14·25	2·34	0·79	0·04	4
Leicester	Apl.-Sep.	65	0·05	2·61	4·69	2·38	2·51	12·24	1·30	0·30	0·10	5
	Oct.-Mch.	82	0·22	3·89	4·96	5·52	4·72	17·31	2·31	0·58	0·16	5
Liverpool	Apl.-Sep.	63	0·19	4·22	8·91	1·93	4·36	19·62	2·39	0·59	0·15	6
	Oct.-Mch.	81	0·23	2·88	6·39	3·49	5·68	18·67	2·82	1·17	0·22	3
London:—												
Meteorological Office ...	Apl.-Sep.	62	0·09	0·72	2·84	2·82	3·70	10·08	1·65	0·72	0·08	6
	Oct.-Mch.	69	0·13	2·43	4·97	2·70	6·75	16·99	2·46	1·06	0·09	6
Embankment Gardens	Apl.-Sep.	55	0·41	5·04	8·38	2·79	6·89	23·50	2·74	1·21	0·13	6
	Oct.-Mch.	63	0·35	4·05	7·53	2·58	7·67	22·17	3·58	1·22	0·09	4
Finsbury Park	Apl.-Sep.	48	0·13	1·85	6·16	0·84	2·60	11·59	1·20	0·34	0·03	6
	Oct.-Mch.	71	0·20	1·88	5·93	1·36	4·64	14·01	2·01	0·56	0·05	6
Ravenscourt Park ...	Apl.-Sep.	52	0·07	1·42	4·51	1·05	2·95	9·99	1·46	0·30	0·09	6
	Oct.-Mch.	71	0·10	2·04	4·57	1·68	5·47	13·86	2·78	0·45	0·09	5
Southwark Park	Apl.-Sep.	56	0·12	2·56	6·85	1·93	5·24	16·71	2·98	0·53	0·11	6
	Oct.-Mch.	69	0·16	3·64	7·32	2·65	7·08	20·85	2·98	0·76	0·10	6
Wandsworth Common	Apl.-Sep.	39	0·05	0·90	3·48	0·72	4·69	9·83	—*	—*	—*	6
	Oct.-Mch.	59	0·07	1·05	3·01	0·91	3·37	8·40	1·57	0·57	0·03	5
Victoria Park...	Apl.-Sep.	50	0·07	1·51	4·62	1·94	4·18	12·32	2·17	0·50	0·10	6
	Oct.-Mch.	57	0·05	1·11	4·45	2·42	7·05	15·07	3·52	0·61	0·06	6
Golden Lane	Apl.-Sep.	64	0·06	3·06	4·70	1·74	3·65	13·22	2·05	0·64	0·18	6
	Oct.-Mch.	74	0·08	3·39	4·85	3·17	4·89	16·37	3·03	0·88	0·24	6
Malvern	Apl.-Sep.	53	0·00	0·22	0·34	0·44	0·68	1·69	0·32	0·17	0·02	4
	Oct.-Mch.	52	0·00	0·08	0·18	0·55	1·15	1·96	0·52	0·22	0·01	3
Manchester:—												
Ancoats	Apl.-Sep.	56	0·10	3·91	10·92	2·21	5·84	22·98	2·82	0·66	0·08	5
	Oct.-Mch.	27	0·11	5·60	11·91	2·48	8·64	28·74	4·03	1·13	0·10	1
Bowdon	Apl.-Sep.	60	0·01	0·46	1·62	0·99	7·25	10·33	1·34	0·28	0·04	6
	Oct.-Mch.	34	0·01	0·48	2·14	0·67	2·44	5·74	1·14	0·43	0·05	1
Davyhulme	Apl.-Sep.	54	0·02	0·99	3·37	1·26	4·03	9·67	2·32	0·46	0·08	6
	Oct.-Mch.	38	0·03	0·98	4·13	1·79	3·64	10·57	1·34	0·83	0·11	1
Moss Side...	Apl.-Sep.	63	0·11	1·25	4·23	1·33	4·68	11·60	2·37	0·62	0·06	6
	Oct.-Mch.	38	0·12	1·90	6·25	1·44	5·42	15·13	2·61	1·08	0·08	1
Philip's Park	Apl.-Sep.	64	0·07	3·02	7·14	2·07	5·70	18·00	2·37	0·80	0·05	6
	Oct.-Mch.	30	0·06	3·42	9·74	1·84	7·21	22·27	2·12	1·10	0·06	1
Queen's Park...	Apl.-Sep.	64	0·06	2·21	4·55	2·04	5·75	14·61	2·79	0·69	0·05	6
	Oct.-Mch.	55	—	—	—	—	—	16·78	—	—	—	4
School of Technology...	Apl.-Sep.	60	0·16	3·04	9·71	1·50	4·85	19·26	2·39	0·63	0·08	6
	Oct.-Mch.	60	—	—	—	—	—	22·95	—	—	—	4
Whitefield	Apl.-Sep.	60	0·03	1·74	4·46	1·65	4·16	12·04	2·53	0·48	0·06	5
	Oct.-Mch.	36	0·06	1·61	4·95	2·29	4·80	13·71	1·90	1·03	0·05	1
Newcastle-on-Tyne	Apl.-Sep.	24	0·13	2·75	6·87	1·08	2·79	13·63	1·38	0·28	0·09	6
	Oct.-Mch.	69	0·28	4·46	7·73	2·39	5·16	20·03	2·53	0·78	0·17	6
Oldham...	Apl.-Sep.	69	0·23	4·83	16·51	1·78	5·40	28·76	2·29	0·66	0·13	6
	Oct.-Mch.	42	0·22	7·97	16·24	3·04	5·40	32·87	2·82	1·09	0·23	1
York	Apl.-Sep.	26	0·06	1·05	2·78	0·81	1·38	6·09	0·64	0·23	0·06	6
	Oct.-Mch.	49	0·15	1·38	2·49	2·60	3·14	9·76	1·75	0·64	0·09	6
Coatbridge	Apl.-Sep.	53	0·10	1·77	4·45	1·10	1·97	9·39	1·15	0·21	0·10	6
	Oct.-Mch.	61	0·08	1·65	3·65	1·51	3·64	10·53	1·63	0·57	0·12	6
Glasgow:—												
Alexandra Park	Apl.-Sep.	51	0·13	1·88	3·50	3·89	3·19	12·60	3·37	0·30	0·22	6
	Oct.-Mch.	77	0·26	1·89	2·27	6·09	8·10	18·62	3·70	1·05	0·20	5
Bellahouston Park ...	Apl.-Sep.	46	0·58	1·40	2·52	0·78	1·92	7·21	1·03	0·16	0·06	6
	Oct.-Mch.	89	0·21	1·09	1·88	4·60	5·76	13·55	3·34	1·04	0·09	5
Blythswood Square ...	Apl.-Sep.	52	0·13	1·64	3·73	2·01	4·34	11·85	2·46	0·21	0·18	6
	Oct.-Mch.	90	0·31	2·42	3·28	4·69	7·38	18·08	4·45	0·88	0·19	6
Botanic Gardens	Apl.-Sep.	49	0·41	1·89	2·83	1·13	2·51	8·77	1·39	0·14	0·06	6
	Oct.-Mch.	101	0·29	1·96	3·12	6·36	8·20	19·93	5·16	1·26	0·16	5
Richmond Park	Apl.-Sep.	51	0·12	1·61	3·39	1·79	3·01	9·94	1·56	0·15	0·14	6
	Oct.-Mch.	94	0·32	1·60	3·03	5·57	6·87	17·38	4·73	0·89	0·25	5
Ruchill Park	Apl.-Sep.	57	0·15	1·60	3·58	1·63	4·27	11·25	2·29	0·15	0·11	6
	Oct.-Mch.	99	0·23	1·41	2·38	4·60	6·52	15·15	2·94	0·81	0·15	5
South Side Park	Apl.-Sep.	52	0·10	1·05	2·46	1·15	2·15	6·93	1·34	0·13	0·08	6
	Oct.-Mch.	95	0·22	1·37	2·24	4·07	5·61	13·52	3·90	0·85	0·14	5
Tollcross Park	Apl.-Sep.	52	0·16	2·69	4·50	1·51	4·52	13·39	1·70	0·15	0·09	6
	Oct.-Mch.	91	0·26	1·58	2·77	5·00	7·01	16·63	4·25	0·86	0·15	5
Victoria Park	Apl.-Sep.	59	0·16	1·26	2·75	2·17	2·92	9·28	1·92	0·15	0·19	6
	Oct.-Mch.	95	0·41	1·24	1·96	5·48	6·89	15·99	4·03	0·94	0·30	5
Greenock	Apl.-Sep.	54	0·05	2·66	5·00	1·60	2·85	12·17	1·38	0·41	0·12	6
	Oct.-Mch.	99	0·14	2·30	3·95	2·25	4·78	13·44	2·12	1·19	0·19	6
Leith	Apl.-Sep.	56	0·05	1·26	3·34	2·08	2·63	9·36	1·13	0·23	0·11	6
	Oct.-Mch.	50	0·06	1·16	3·12	2·27	3·32	9·93	1·67	0·58	0·18	5

* Results unreliable.

TABLE V.—*Classification.*

April to September, 1915. Station.	No. of months	Rainfall in mm.	Tar.	Carbonaceous other than tar.	Ash.	Loss on ignition.	Ash.	Total solids.	Sulphuric acid.	Chlorine.	Ammonia
Unit for classification			0·05	1	2	0·75	1·5	5	1	0·3	0·05
Birmingham, Central	1	79	C	B	C	B	B	B	B	B	B
,, Aston	5	57	B	B	C	B	B	B	B	A	A†
,, S.W.	6	52	A	B	B	A†	B	B	B	A	A
Bolton	5	84	B	B	B	C	C	C	C	C	B
Exeter	6	46	A	B	B	B	B	B	A	A	A*
Kingston-upon-Hull	6	46	B	C	B	B	B	B	B	B	A
Leicester	5	65	B	B	B	C	B	B	B	B	B
Liverpool	6	63	C	C	C	B	B	C	B	B	C
London:—											
Meteorological Office	6	62	B	A	B	C	B	B	B	B	B
Embankment Gardens	6	55	D†	D*	C	C	C	C	B	C	B
Finsbury Park	6	48	B	B	C	B	B	B	B	B	A†
Ravenscourt Park	6	52	B	B	B	B	B	B	B	B	B
Southwark Park	6	56	B	B	C	B	C	C	B	B	B
Wandsworth Common	6	39	B	A	B	A	C	B	Un.	Un.	Un.
Victoria Park	6	50	B	B	B	B	B	B	B	B	B
Golden Lane	6	64	B	C	B	B	B	B	B	B	C
Malvern	4	53	A*	A*	A*	A*	A*	A*	A*	A	A*
Manchester:—											
Ancoats	5	56	B	C	D†	B	C	C	B	B	B
Bowdon	6	60	A†	A†	A†	B	C	B	B	A	A
Cheadle	5	60	B	B	B	B	B	B	B	B	B
Davyhulme	6	54	A	A	B	B	B	B	B	B	B
Fallowfield	6	54	A	B	B	B	B	B	B	B	A
Moss Side	6	63	B	B	B	B	C	B	B	B	B
Philip's Park	6	64	B	C	C	B	C	C	B	B	B
Queen's Park	6	64	B	B	B	B	C	B	B	B	B
School of Technology	6	60	C	C	C	B	C	C	B	B	B
Whitefield	5	60	A	B	B	B	B	B	B	B	B
Newcastle-on-Tyne	6	24	B	B	C	B	B	B	B	A	B
Oldham	6	69	C	C	D*	B	C	D*	B	B	B
Sheffield:—											
Attercliffe	3	28	B	C	C	B	B	C	B	C	A
Hillsborough Park	3	35	B	B	B	B	B	B	B	B	A
Meersbrook Park	3	35	B	B	B	A	B	B	B	B	A
Weston Park	3	35	B	B	B	B	B	B	B	B	A
York	6	26	B	B	B	B	A†	B	A†	A	B
Coatbridge	6	53	B	B	B	B	B	B	B	A	B
Glasgow:—											
Alexandra Park	6	51	B	B	B	D*	B	B	C	B	C
Bellahouston Park	6	46	D*	B	B	B	B	B	B	A	B
Blythswood Square	6	52	B	B	B	B	B	B	B	A	C
Botanic Gardens	6	49	D	B	B	B	B	B	B	A†	B
Richmond Park	6	51	B	B	B	B	B	B	B	A	B
Ruchill Park	6	57	C	B	B	B	B	B	B	A	B
South Side Park	6	52	B	B	B	B	B	B	B	A*	B
Tollcross Park	6	52	C	B	B	B	C	B	B	A	B
Victoria Park	6	59	C	B	B	B	B	B	B	A	C
Greenock	6	54	B	B	B	B	B	B	B	B	B
Leith	6	56	B	B	B	B	B	B	B	A	B

Un., Unreliable.

* Indicates the letters representing the highest and lowest records for each element in the list of stations.

† Indicates the second (if there is one) in Class A or Class D.

Ammonia.—* Exeter and Malvern equal. † Birmingham (Aston) and Finsbury Park equal.

In Table IV. the summer and winter deposits are compared, and if we eliminate from this any stations having less than 4 months' observations in either summer or winter we find that a comparison of the amounts of deposit gives the following result:

Comparison of Summer and Winter Deposit for Year April, 1915, to March, 1916.

	Winter deposit greatest in: Stations.	Deposits equal.	Summer deposit greatest in: Stations.
Rainfall	24	—	1
Tar	19	1	5
Carbonaceous Insoluble	14	—	11
Ash	7	—	18
Loss on ignition	23	—	2
Soluble Ash	24	—	1
Total solids	23	—	2
Sulphates	23	1	0
Chlorine	24	—	0
Ammonia	18	2	4

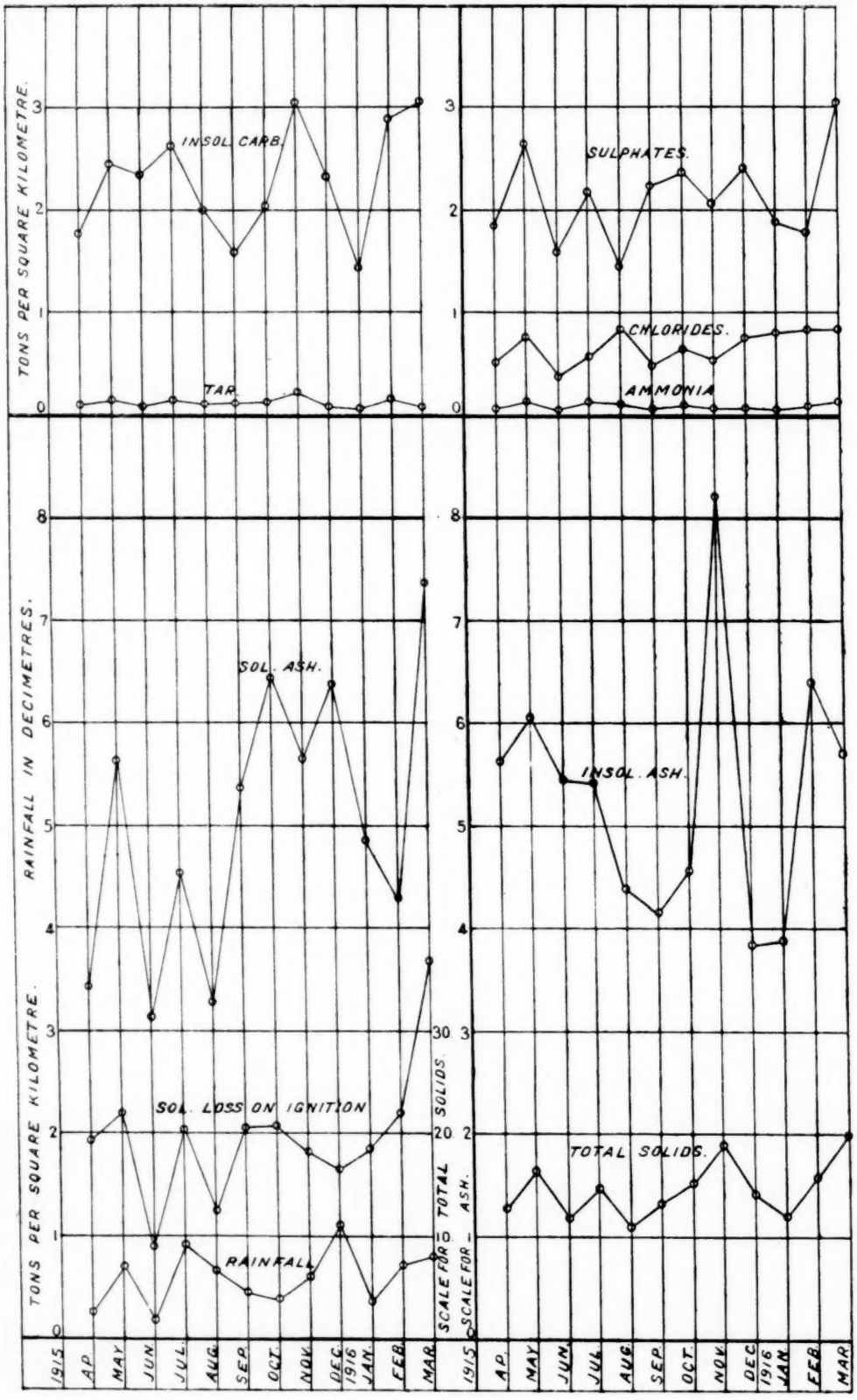
It must be kept in mind that we are now comparing the *number of stations* at which the summer or the winter deposit of any particular element of deposit had the preponderance; this is not a comparison of *quantity* deposited and would only be such if all stations had the same amount of deposit.

We note at once that insoluble carbonaceous matter and ash again stand out, the latter as the only case in which the number of stations showing a greater deposit in summer than winter exceeded the number with greatest winter deposit, and the former approaching the same condition. In all other cases the number of stations with greatest winter deposit greatly exceed the number with greatest summer deposit.

It is to be carefully noted that no legitimate inference as to relation of rainfall and deposit can be drawn from these figures. Doubtless the summer preponderance of insoluble ash is due to dust.

FIG. II.

Average Deposit of each Element of Pollution for each Month for Group of London Stations. Prepared from Table X.



The relations are here more obscure than when the larger number of stations were used. While rainfall was greatest in December, no other constituent of the deposit had its maximum in December. When these figures are plotted in curves they give very irregular results. (Fig. II.) All that can be said is that the soluble constituents correspond more closely with the rainfall than do the insoluble. It would seem on studying the curves, both in this case and Fig. I., that for a while some relation holds good, perhaps for four or five months, and then suddenly it breaks down. It looks as if there was some fundamental relationship overlaid by erratic occurrences which completely obscure it for a time.

In the case of the London stations some such disturbance seems to have taken place about November, 1915, but what its nature was is not easy to say.

Looking at the last column in Table X. we again notice that insoluble carbonaceous matter and ash show less variation in the deposit before being converted to a uniform 100 mm. rainfall, and this in spite of the fact that the monthly rainfall varies from 1 to 6·2 during the year considered. All the other elements of deposit exhibit the same characteristic but in a less marked degree, thus bearing out the conclusion drawn from Table IX.

Referring to the remarks made previously as to the seasonal incidence of ammonia, it is interesting to note for the period April, 1915, to March, 1916, and for the group of London stations considered, that the summer months gave a mean monthly deposit of 0·106, while the mean for the following winter, October to March, was 0·102 ton per K², showing a slight preponderance of deposit during the summer. The difference is not great enough to base any conclusions upon, but may be noted as indicating, if anything, a slight tendency for ammonia to be present in the water collected in greater quantity in summer than in winter.

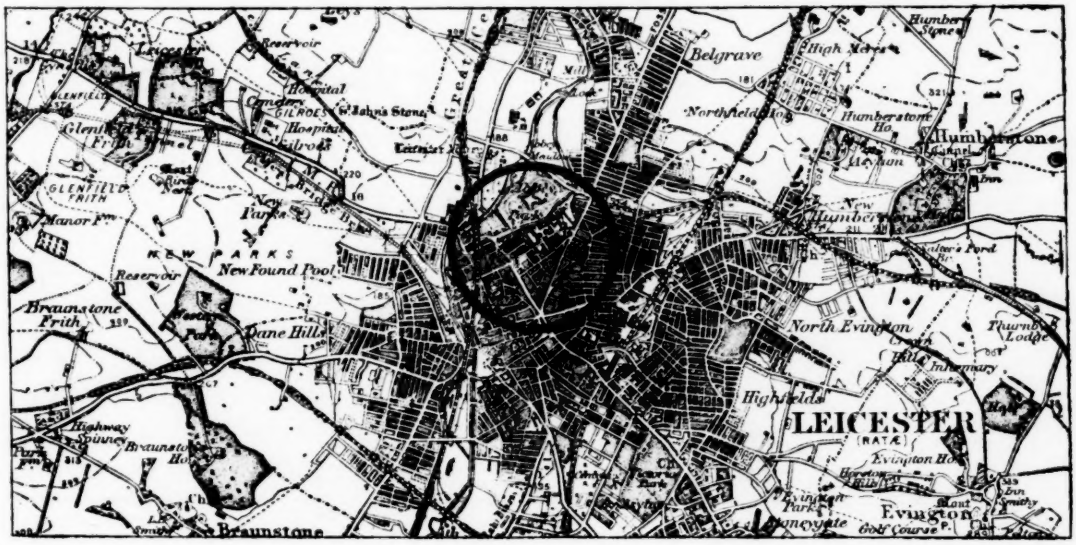
Speaking generally, the Committee feel that in a report of this nature their special duty is to place the statistics on record rather than attempt to deduce any far-reaching conclusions at the present stage of the inquiry. For the reasons already given, the tabular results are presented now in a somewhat abbreviated form, and it has not been possible to analyse in detail the figures from every station. It is hoped, however, that as accurate statistics are made available this will result in stimulating inquiry.

MAPS OF DISTRICTS SHOWING POSITIONS OF THE STANDARD GAUGES

ADDITIONAL TO THE 17 MAPS GIVEN IN THE REPORT FOR THE YEAR 1914–1915

(SCALE, ONE INCH TO THE MILE.)

LEICESTER



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***INDICATIONS.*—SYPHILIS, RHEUMATISM, the various phases of TUBERCULOSIS, GENERAL DEBILITY, &c.**

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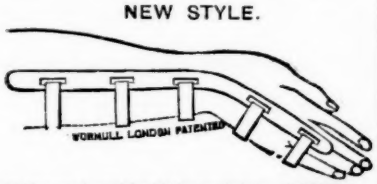

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